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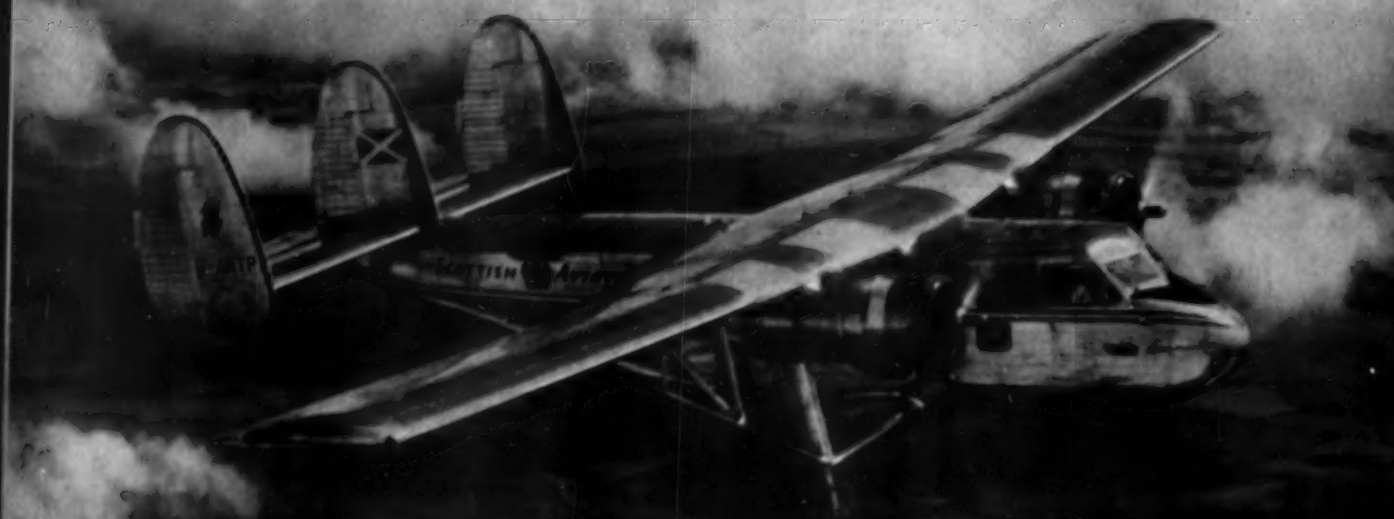

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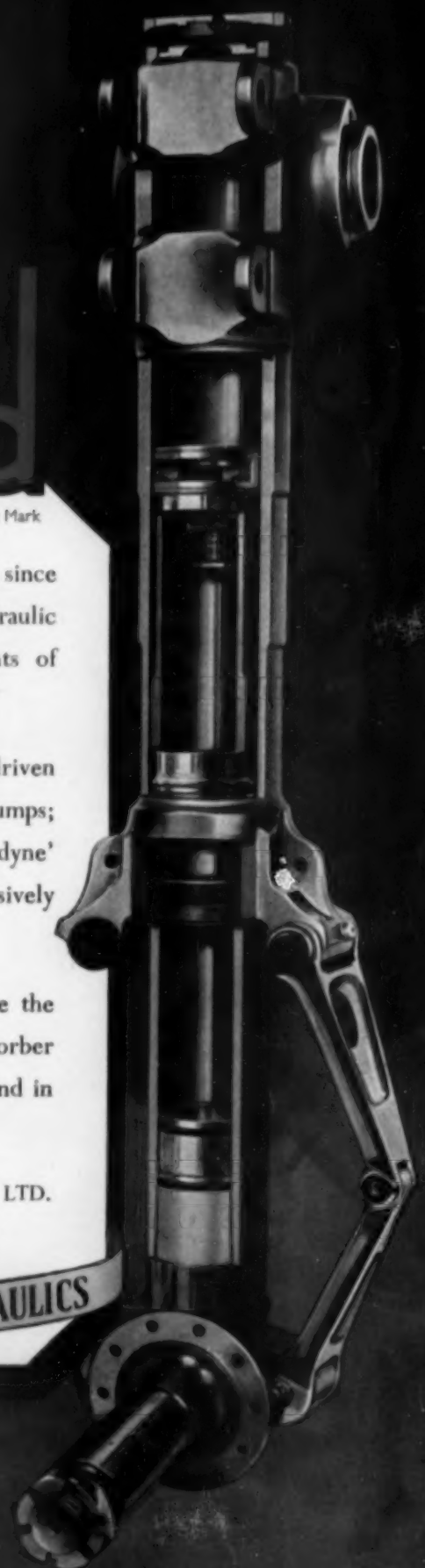

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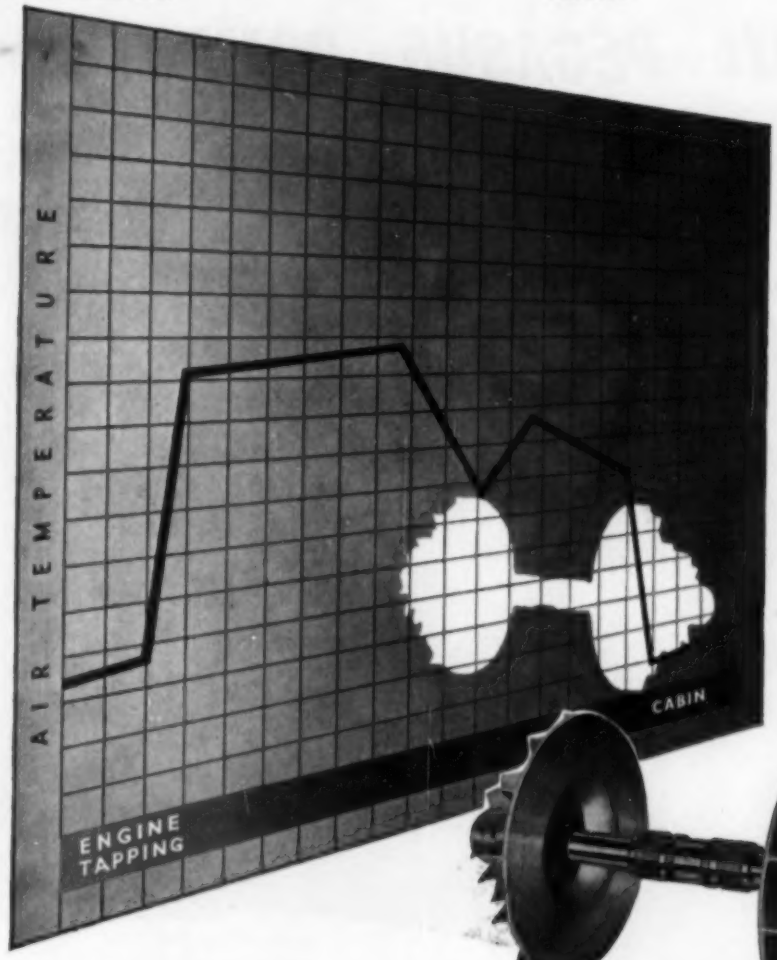

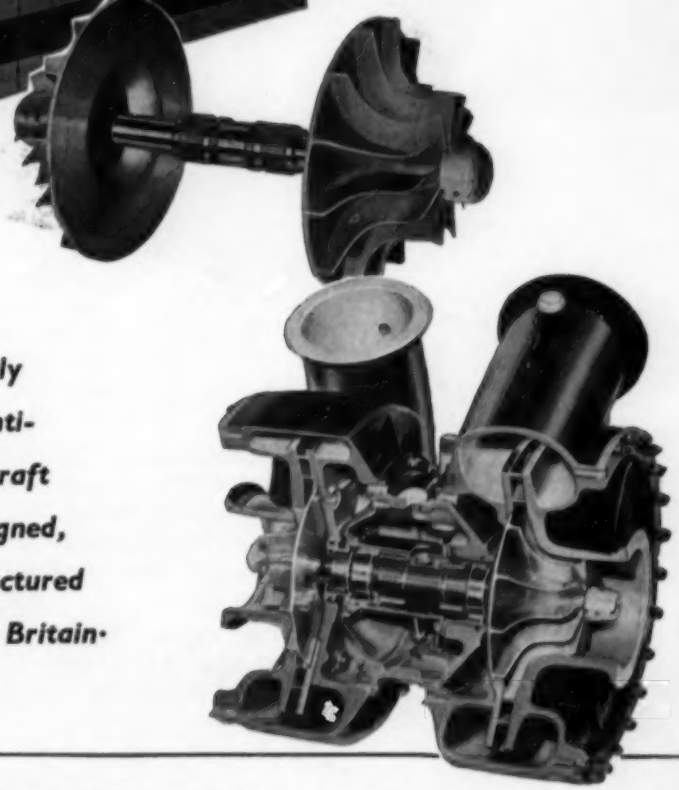

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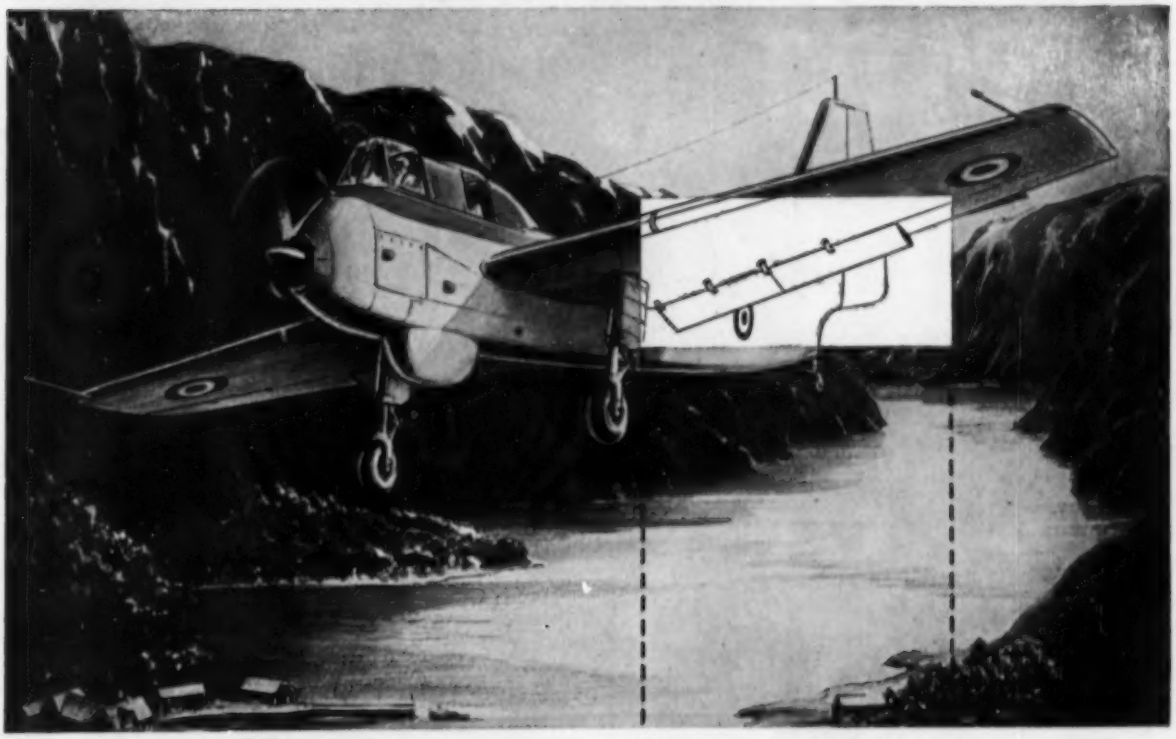
Coastal waters — *Seamew* guarded



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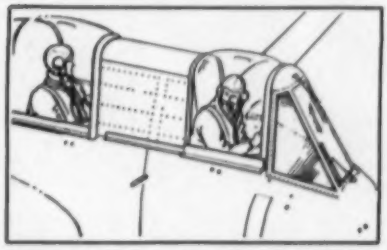
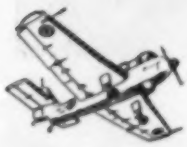
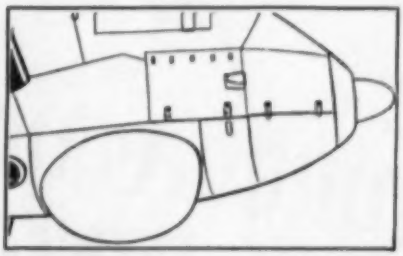


Pilot and Observer have perfect vision for take-off, attack and landing; a powerful asset in adverse weather — submarine weather.

The *Short* answer is the *Seamew*





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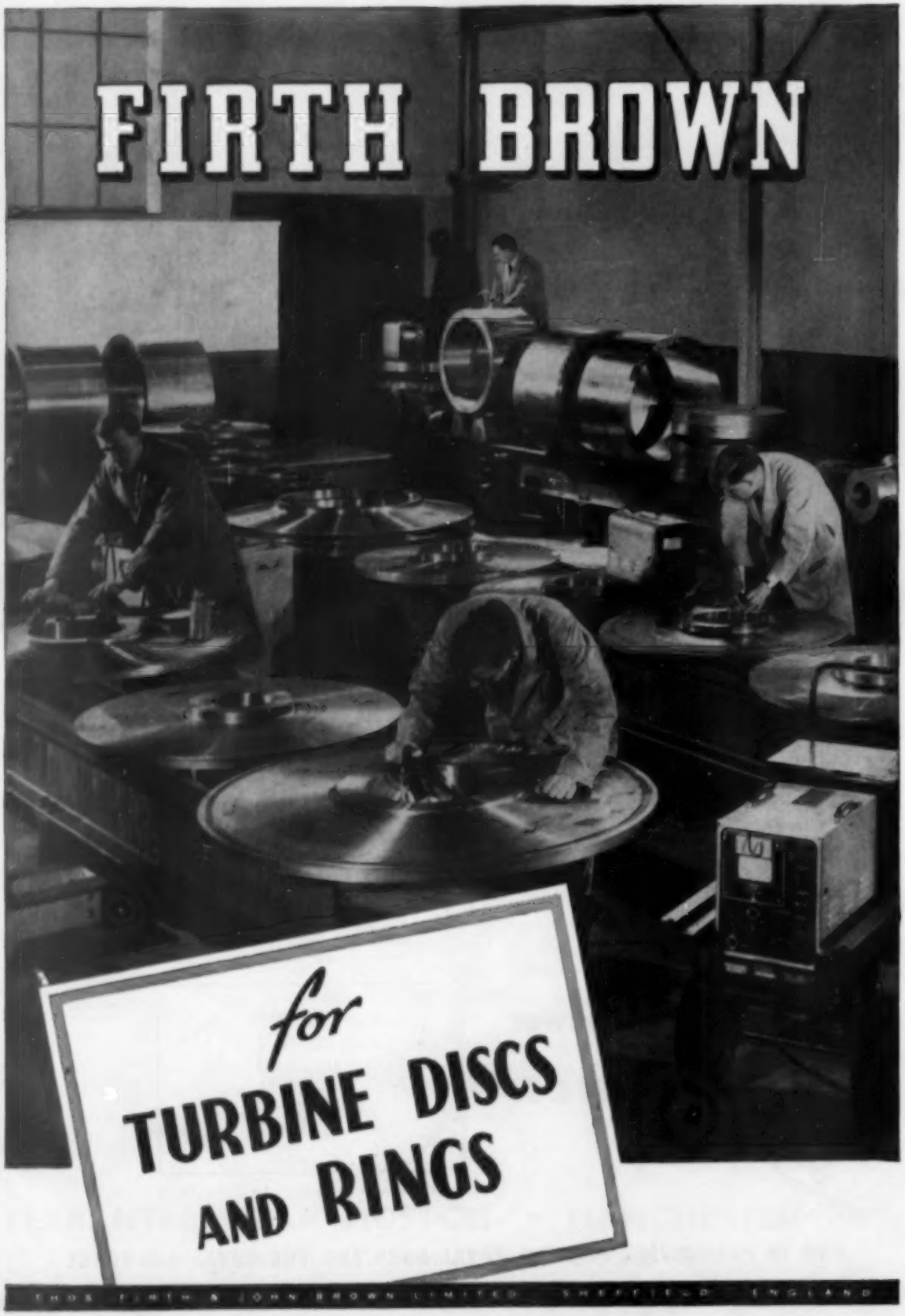
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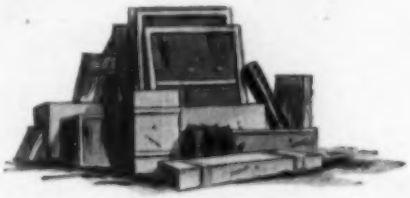
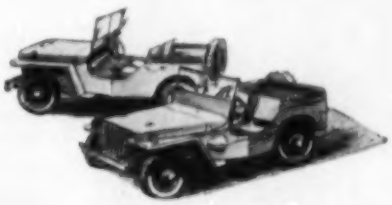


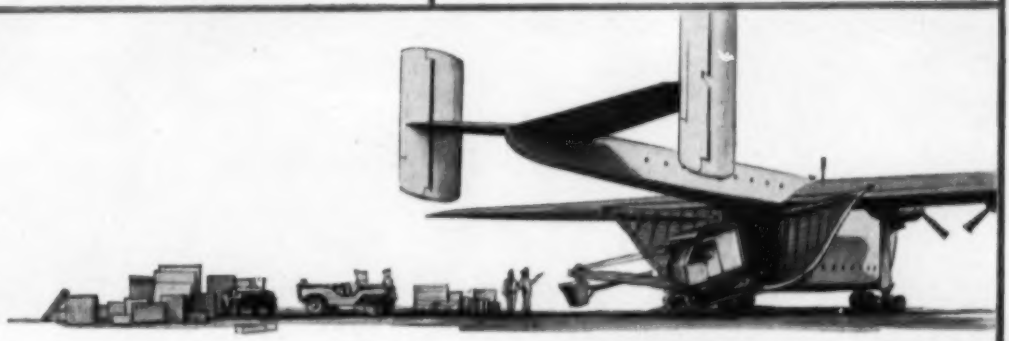
. . . stores . . .

. . . more stores . . .

. . . heavy equipment . . .



. . . base transport . . .



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The Universal has a main freight compartment 10 feet high, 10 feet wide, 40 feet long and a payload of 50,000 lb. Forty-two passengers can be accommodated comfortably in airliner type seats in the rear cabin.

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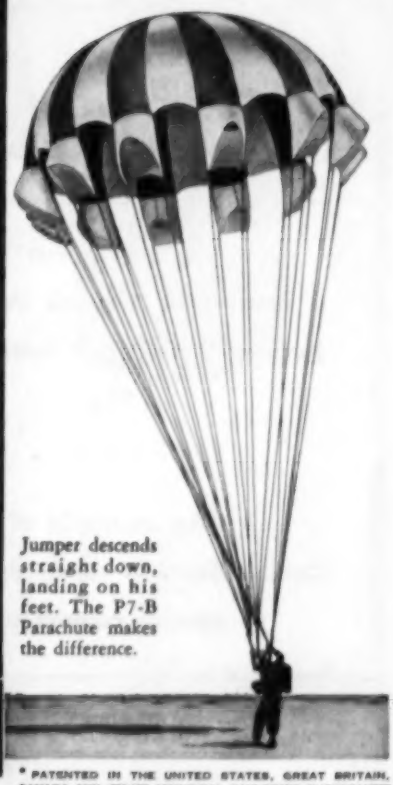

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Nominal bore	4·1"
Material	Light alloy
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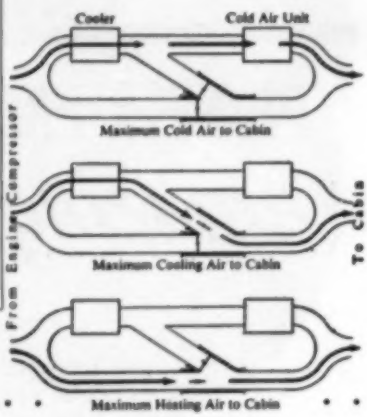
Through air pressure	50 p.s.i.
Through air temp.	280°C.
Ambient temp. (max.)	150°C.
Max. leakage	0·46 lb./min.
Pressure drop across valve:	
	0·55" W.G. at 300 C.F.M. at N.T.P.
	2·9" W.G. at 600 C.F.M. at N.T.P.
No. of ways—IN	TWO
—OUT	ONE
Actuator	Teddington Mk. 2
Time	4·5 min. for full change-over
Voltage	24 V. D.C. nominal
Follow-up resistor	Type FLJ/A/15
Overall dimensions	11·5" x 10·8" x 10·3"



This valve forms part of a Temperature Control System and mixes the supply of hot and cold air to give the desired temperature in an aircraft cabin. It functions in the manner illustrated in the diagram and is capable of modulation between the three positions shown.

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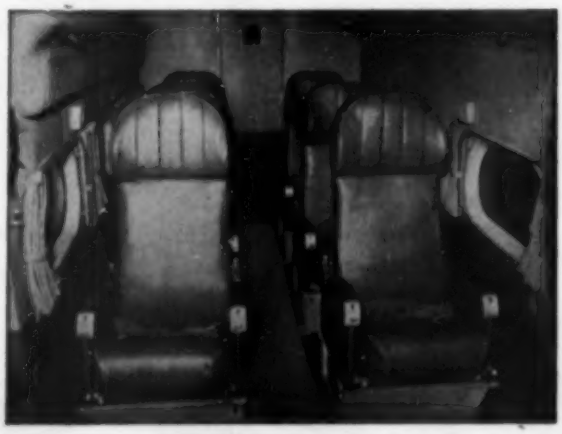

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First Aeronautical Weekly in the World

Founded 1909

No. 2442 Vol. 68. FRIDAY, 11 NOVEMBER 1955

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Seeing at Night

A YEAR or so ago we took the occasion of Exercise Battle Royal to write in this column about air reconnaissance. That science had been described by the C-in-C. 2nd A.T.A.F. as being of supreme importance, for it was of no use relying on atomic weapons to win a land battle, he said, without adequate and speedy reconnaissance to locate suitable targets. The article concluded with some rather depressing observations concerning the effect of weather, the exercise having shown that the squadrons were often grounded, whereas the 280 mm atomic cannon was by nature an all-weather creature.

After the conclusion of Battle Royal a senior officer of 2nd A.T.A.F. declared that the weather problem would have to be looked at a great deal more closely; and that this introspection has proved rewarding is evident from an official pronouncement on pages 739-740 of this issue. Progress is reported, though its extent and direction are not specified. More definite, however, is the disclosure that, although daylight reconnaissance is limited by weather to about one-sixth of the month, night photography is possible over a considerably longer period. Hence there is a new emphasis on the technique of flare-dropping. As to advances in this direction, we must again revert to Battle Royal, wherein we ourselves were surprised to find that for night reconnaissance a small number of Douglas RB-26 Invaders had been attached to the P.R. force out of sheer necessity. This discovery was disagreeable for two reasons: that no equivalent British aircraft were available, and that the Invader was obsolescent in terms of performance. Within a year the situation has improved to the point where the Invaders are giving way to B-57 Canberras (two have been visiting English Electric in recent days), and where R.A.F. Canberras are becoming increasingly available to 2nd A.T.A.F. And if there is a more effective night-reconnaissance aircraft than the Canberra we should be interested to hear of it. As a Meteor replacement in the fighter/reconnaissance class the Service is receiving a special development of the Swift—the F.R.5—and at the S.B.A.C. Display this year it was seen that Hawker Aircraft are developing the Hunter along similar lines.

—and at a Distance

From the foregoing it will have been gathered that the tactical reconnaissance situation is by no means cheerless. As for strategic recce. (which postulates extreme altitude and range) the R.A.F. is served at present by Canberras of the marks P.R.3 and 7, the latter being, in all probability, as effective as any comparable machine in the air today. True, the RB-47s of America's Strategic Air Command may have longer range and be more elaborately equipped; but they carry no more cameras than the Canberra—seven—and are certainly inferior in ceiling. The height potential of the Canberra is implicit, of course, in its successive elevation to the world's altitude record, first to 63,668ft, then, during August this year, to 65,876ft. Its newest, if not its ultimate, P.R. derivative is the Mk 9, with increased wing area and advanced Avons—innovations which should guarantee an over-target ceiling in the order of 60,000ft. In the reconnaissance business it is literally a matter of the higher the fewer, and it is our belief that the operational ceiling of the P.R.9 is not attained, nor even closely approached, by any reconnaissance machine (or, for that matter, fighter) in service or in immediate prospect. At somewhat lower levels—but presumably over greater ranges—special versions of the V-bombers could be made available, and the P.R. fraternity must have cast a more than casual glance at the Javelin, a fighter which combines speed, range and altitude performance in uncommon degree. But whatever the qualities of forthcoming reconnaissance machines may prove to be, the future of the class is already darkened by the twin spectres (we intend no pun) of mixed-power intercepters and air-to-air homing missiles. As target penetration becomes more hazardous, of course, there will be progressive developments in reconnaissance techniques. The present Ficon system, for instance, might well be developed to the point where the air-launched piloted component could be abandoned in favour of a drone vehicle of extreme performance. Rarely, in fact, was there more scope for ingenuity—nor more need of it.

VISITING THE SEAMASTER: Martin president George M. Bunker (left), with George Rodney, test pilot of the XP6M-1 SeaMaster, chats with Earl Mountbatten as Admiral Arleigh Burke, Chief of U.S. Naval Operations (right) is interviewed by the Press after watching a demonstration by the big four-jet minelaying flying-boat.

FROM ALL QUARTERS

Arabian Airlift

REGISTERED G-AOEK, a Blackburn Universal freighter (civil counterpart of the Beverley) has commenced a transport operation under desert conditions in which heavy and bulky oil-well drilling equipment will be transported from Umm Said in the Qatar Peninsula to Jebel Fahud in the Sultanate of Muscat and Oman. The operation is a joint venture by Hunting-Clan Air Transport and Blackburn and General Aircraft, Ltd.

Disclosing this notable venture, Blackburn Aircraft remark that Umm Said is an important oil terminal and a stores base for operations in the area. Fahud is a rocky formation about 100 miles south-west of the mountains of Oman, which as a result of geological surveys has been selected as a site for a test well. While Umm Said is a well-established oil port; Fahud is as yet only a camp in barren desert. The available aerodrome is little more than levelled strips of desert, but since the Universal is designed for operating in such conditions this presents no difficulties. The only possible route from Umm Said to Fahud involves a journey of 1,050 miles by sea and across the desert, taking at least two weeks.

Geographical barriers described as "practically insuperable" isolate Fahud from the east and west and access from the north is difficult. The only practical land access to Fahud, therefore, is from the south, involving a journey of 350 miles across the desert on the very rough track from Ras Duqm on the south coast. The journey by sea from Umm Said to Ras Duqm has its own special difficulties: the distance is 700 miles and all cargo has to be transferred to a landing barge off shore to make a landing through the surf on the sandy beach. Beach landings and desert crossings involve a serious risk of damage to the loads and this fact materially adds to the overall cost.

A Blackburn statement adds: "The air distance between Umm Said and Fahud is 365 miles, so that air transport involves a simple flight of about two hours. From the very beginning of operations in the Fahud area the oil company has used air transport for urgent and valuable equipment and for personnel. About 1,000 tons of equipment have been moved in by air and there have been about 2,000 passenger journeys in and out of Fahud. The aircraft used up to now have a limited hold size and payload and are unable to carry that equipment which cannot be broken down into small units. The only aircraft capable of carrying these large indivisible loads is the Universal."

The aircraft, it is stated, has been made available for carrying only those urgent loads which cannot be carried in any other machine. It is capable, however, of handling all the equipment which has been, or is to be, shipped by sea.

Earl Mountbatten at Baltimore

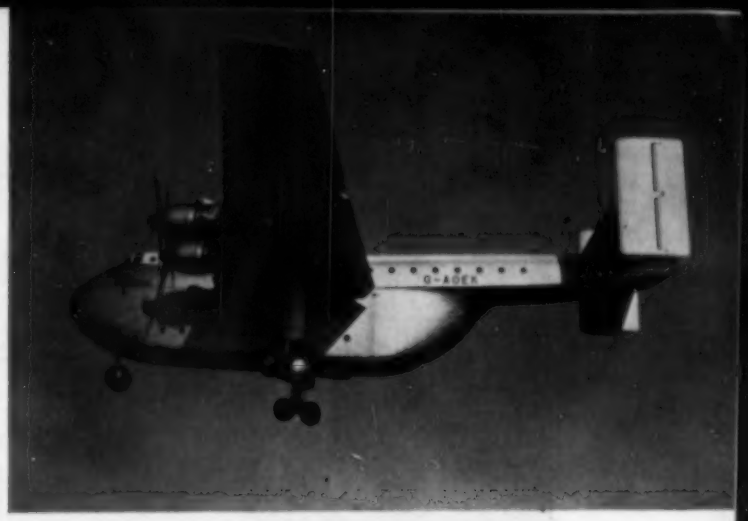
ENTHUSIASM was expressed concerning the Martin XP6M-1 SeaMaster by Admiral Arleigh Burke, America's Chief of Naval Operations, and his guest, Admiral the Earl Mountbatten of Burma, K.G., First Sea Lord and Chief of Naval Staff, when they visited Baltimore recently. The two Navy leaders were accompanied by Vice-Admiral T. S. Combs, Deputy Chief of Naval Operations for Air, and Rear-Admiral James S. Russell, Chief of the Bureau of Aeronautics. The party had flown direct from the Pentagon by helicopter.

Admiral Burke disclosed that "a sample order" for SeaMasters is already in the Navy's 1956 budget, and that the number to be ordered in the 1957 budget will depend on the funds made available by Congress. Thereafter production orders will continue to be limited by the extent of the yearly appropriations.

From a yacht in Chesapeake Bay the Admirals saw a demonstration of the SeaMaster. Take-off is described as having been "swift", and test pilot George Rodney executed a fast, low run at nearly 600 m.p.h. With flaps down the SeaMaster passed by at about 160 m.p.h. On one run the watertight mine-door was rotated. Admirals Burke and Mountbatten also inspected the second P6M-1 SeaMaster, which is fitted out with complete navigational, bombing and communications systems planned for production versions. Superficial design-changes have been incorporated in this second machine.

The SeaMaster is powered by four Allison J71 turbojets with take-off afterburners, and carries a 30,000 lb disposable load. Designed cruising altitude is 40,000ft.

TAKING THE AIR for the first time for the preliminary runs of its Rolls-Royce Dart turboprops is the prototype Fokker Friendship. A complete description of this promising "Dakota replacement" appeared in "Flight" of June 3rd this year. Many British components are used.



***SHIP OF THE DESERT:** The Blackburn Universal, registered G-AOEK, which, as related on the previous page, is undertaking a man-size task in South-east Arabia, moving heavy oil-drilling equipment.*

Commonwealth Research Council Meeting

THE fourth meeting of the Commonwealth Advisory Aeronautical Research Council is due to begin today, November 11th, in Canberra, Australia, and is to continue until December 3rd. Representatives of the United Kingdom, Canada, New Zealand, South Africa, India, Pakistan and Ceylon have been invited to attend the meeting, the chairman of which will be Prof. A. V. Stephens, Professor of Aeronautics in the University of Sydney.

The Council was formed, following a preliminary meeting in London in 1946, with the object of co-ordinating the research programmes of the Commonwealth countries. At its biennial meetings, it reviews progress in the various countries, advises on the broad planning of programmes, suggests suitable items of work which might be undertaken in particular countries and recommends the provision of new facilities for research where necessary. It promotes the interchange, secondment and visits of scientific workers from one country to another, and the dissemination of scientific information on aeronautics within the Commonwealth.

United Kingdom delegates to this year's meeting are Mr. E. T. Jones (Principal Director of Scientific Research (Air), M.o.S., and chairman of C.A.A.R.C. central secretariat), Prof. W. J. Duncan (Professor of Aeronautics and Fluid Mechanics, Glasgow University), and Prof. E. J. Richards (Professor of Aeronautical Engineering, Southampton University). Official observers will be Mr. M. B. Morgan (Deputy Director (Aircraft), R.A.E.), Dr. R. C. Pankhurst (Senior Principal Scientific Officer, Aerodynamics Division, N.P.L.) and Mr. C. H. E. Warren (Senior Principal Scientific Officer, Aerodynamics Department, R.A.E.).

The V.1000

ALTHOUGH no official statement has yet emerged from either the Ministry of Supply or the manufacturer it is now common knowledge that the Vickers-Armstrongs V.1000 transport (four Rolls-Royce Conway by-pass turbojets) is unlikely to be built in quantity. Work on the prototype is well advanced.

de Havilland Reorganization

A MAJOR reorganization of the de Havilland Enterprise was announced last Tuesday. Up to the present the Aircraft Company has been in the rather anomalous position of being both an operating company and the parent company of the group. This was a convenient arrangement while the business of the subsidiaries remained comparatively small. In recent years, however, the Engine and Propeller Companies, and certain of the overseas subsidiaries, have expanded greatly. The directors therefore propose to follow the accepted practice of forming a holding company with operating subsidiaries. At an extraordinary general meeting, to be held at Hatfield on November 30th, stockholders will be invited to agree to the proposal that the present Aircraft Company, which will be the holding concern for all the de Havilland companies at home and overseas, shall be renamed de Havilland Holdings, Ltd. This will enable the subsidiary which takes over the aircraft manufacturing and trading activities to assume the title "The de Havilland Aircraft Co., Ltd." The change-over would be effective from November 30th.

The three main operating subsidiaries at home will then be: The de Havilland Aircraft Co., Ltd., The de Havilland Engine Co., Ltd., and de Havilland Propellers, Ltd. Each of these companies will be represented on the Board of de Havilland Holdings, Ltd., the holding company, which will be responsible for finance and for co-ordination of policy.

Mr. A. F. Burke will take over the office of managing director of the Aircraft Company on January 1st, and Mr. H. Buckingham will then assume the duties of principal executive of the Engine Company, as general manager. Until that date Mr. W. E. Nixon will be managing director of the Aircraft Company and Mr. A. F. Burke managing director of the Engine Company.

The Boards of the holding company and the three subsidiaries in England will be constituted as follows (it is interesting to observe that the office of "president," unusual in this country, has been adopted):—

de Havilland Holdings, Ltd.—*Directors:* W. E. Nixon (*chairman and managing director*), Sir Geoffrey de Havilland, F. T. Hearle, F. E. N. St. Barbe, A. F. Burke, A. S. Kennedy, Sir Ralph Sorley.

The de Havilland Aircraft Co., Ltd.—*President:* Sir G. de Havilland. *Directors:* W. E. Nixon (*chairman*), A. F. Burke (*managing director*), F. E. N. St. Barbe, R. E. Bishop, H. Povey, C. S. Thom, R. M. Clarkson, A. S. Kennedy.

The de Havilland Engine Co., Ltd.—*President:* Sir G. de Havilland. *Directors:* A. F. Burke (*chairman*), H. Buckingham (*general manager*), W. E. Nixon, J. L. P. Brodie, E. S. Moult, M. G. Ash.

de Havilland Propellers, Ltd.—*President:* Sir G. de Havilland. *Directors:* W. E. Nixon (*chairman*), Sir Ralph Sorley (*managing director*), A. S. Kennedy, R. E. Bishop, G. C. I. Gardiner, C. R. Burgess.

The five overseas subsidiaries are The de Havilland Aircraft of Canada, Ltd., de Havilland Aircraft (Pty.), Ltd., The de Havilland Aircraft Co. of New Zealand, Ltd., The de Havilland Aircraft of South Africa (Pty.), Ltd., and—in the United States—de Havilland Aircraft, Inc. Sir Geoffrey de Havilland is president of the four Commonwealth companies.

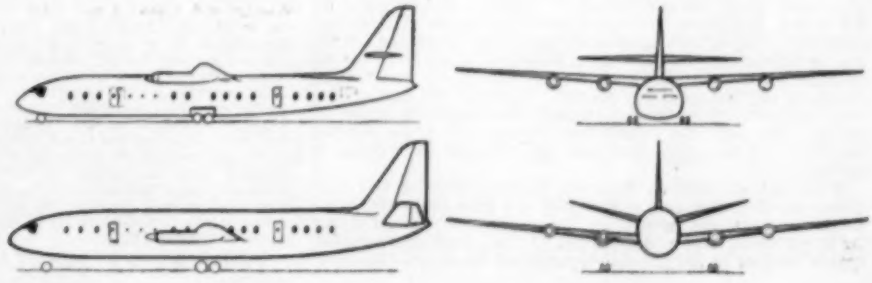
World Gliding Championships: U.K. Team

THE names of the pilots who will represent Britain in the 1956 World Gliding Championships in France have been announced by the British Gliding Association. In a list of thirteen seeded pilots, Nos. 1 to 4 are Philip Wills, Geoffrey Stephenson, Cdr. Nick Goodhart and Lt. Col. Tony Deane-Drummond. First reserve pilots, seeded 5th and 6th, are Frank Foster and Peter Bisgood.

The number of sailplanes to be entered by each country has not been disclosed, but will probably be one two-seater and either one or two single-seaters. From the aircraft available, the British pilots will choose their aircraft in the seeded order. The championships will probably be held at St. Yan towards the end of June, but final dates and location have yet to be announced.

Of the pilots named above, Wills (present British National champion) was world champion 1952-54 and runner-up to Pierre in the 1954 world contests. Stephenson was British National champion 1953-55. Goodhart achieved top points in this year's American Nationals and Deane-Drummond came second in the 1955 British Nationals.

Pilots seeded 7th to 13th (who are unlikely to be called upon) are respectively David Ince, Lorne Welch, Dan Smith, F/O. K. C. Fitzroy, Cpl. A. Gough, J. C. Cotton and F/L. R. C. Jones.



***PROJECTS** which led up to the Vickers-Armstrongs Vanguard, both of which were designed around the Rolls-Royce RB.109 (Tyne) turboprop. The upper, high-wing design was for a single-deck (not double-bubble) aircraft weighing 101,000 lb and cruising at 420 m.p.h.; the other was for a 100,000 lb mid-wing machine cruising at 415 m.p.h. These drawings are taken from the current "B.E.A. Magazine."*

The pleasing proportions of the Britannia 300 are apparent from this picture, taken last week, of the first aircraft. It is due to fly before the summer. Note the protective clothing which guards the pressure hull from manufacturing scratches.

BRITANNIA PROGRESS REPORT

Results of Last Summer's Development Programme: Orders and Deliveries

WITH well over 2,500 test flying-hours to its credit, the Bristol Britannia 100 is now approaching the threshold of its introduction to regular airline service. Three production aircraft should be ready for delivery to B.O.A.C. by the end of the year and the remaining 12 Mk 100s are in various phases of final assembly; the fourth Britannia 100, G-ANBD, has reached the engine-running stage and the fifth is not far behind it.

Rate of production, therefore, is not the factor which will decide the date of introduction to service (on the London-Johannesburg route); this is largely dependent on the issue of a Certificate of Airworthiness.

The bulk of C. of A. testing was in fact completed during the past summer, and the Air Registration Board are in possession of all the resulting data. When the Certificate of Airworthiness has been issued B.O.A.C. will take delivery of their first aircraft to begin a final pre-service programme of route-proving and training. With memories of recent Britannia proving flights in mind, many readers may query the necessity for a second series of overseas flights. The explanation is that trips made so far have been intended largely to prove the *aircraft* under route conditions; the B.O.A.C. programme will prove the *service* in all its aspects, which represent too many birds to succumb to a single stone.

Every pilot, for example, must be checked out on instrument procedures at every airport on the Johannesburg and—a little later—Sydney routes. The best of a number of theoretical cruise procedures must be determined in practice. Replacement of 40/56-seat Argonauts by 90-seat Britannias cannot be effected overnight without training ground staff, of all grades, to handle the new aircraft. Scores of new Britannia crews have yet to undergo their basic flying conversion courses—a task which cannot be delayed overlong, since the Britannia 100 fleet should build up fairly rapidly to full strength after the introduction to service. The later the introduction, in fact, the larger will be the fleet and the more profound its influence on B.O.A.C.'s operations.

A fair amount of work, then, has yet to be done by B.O.A.C. before the Britannia gets into service. In Bristol's hands, however, prototype and production Britannias have already flown far more hours, over a wider range of tests, than any previous type of airliner in the pre-delivery stage of its career. This fact stems from a decision taken just over a year ago—in October, 1954, when it was agreed between Bristol and B.O.A.C. that the Britannia should amass a total of 2,000 flying hours, including 250 hours of overseas route-proving trials, before delivery. Bristol's flight-test team set themselves the task of completing this programme by mid-1955, the target date also for the C. of A. Starting with a total of some 700 hours in January this year, Britannias had passed the 2,000 hr mark by July 1955, and the 250 hr of route-proving by 19th October last, in the course of an intensive round-the-clock programme involving four aircraft, with duties allocated broadly as follows: G-ALBO (prototype)—engine and airscrew development, electrics and radio; G-ANBA—performance, functioning of systems, autopilot; G-ANBB—handling; G-ANBC—route-proving.

The opportunity was taken by B.O.A.C. during the programme to familiarize crews with the Britannia. In fact, by the end of 1954 G-ALBO was being flown almost entirely by the Corporation's officers, and to date a total of 17 crews have been checked out.

The route trials, undertaken by G-ANBC between September 9th and October 19th, were as follows:—

September 10-14th: Johannesburg *via* London Airport, Cairo and Nairobi (45 hr 59 min); *15-18th:* Johannesburg *via* London Airport, Cairo and Nairobi (42 hr 11 min); *20-21st:* Idris *via* London Airport, with full passenger load, primarily for check on functioning of cabin atmosphere system (11 hr 55 min); *22-23rd:* Rome *via* London Airport (circuitious route). Originally planned for Idris, but plans changed owing to B.O.A.C. crash there (12 hr 13 min); *25-29th:* Entebbe *via* London Airport and Cairo. Local flight from Entebbe for anti-icing tests (34 hr 34 min); *October 1-6th:* Karachi *via* London Airport and Cairo. Intended to fly to Bombay but diverted to Karachi by bad weather (39 hr 16 min); *8-10th:* Tel Aviv *via* London Airport. Demonstration flight at Lod on October 9th. On return flight to L.A.P. aircraft stacked over Epsom for 1 hr 50 min (23 hr 32 min); *12-19th:* Nairobi *via* Rome and Khartoum. Local flight from Nairobi for anti-icing tests, and local test flight at Khartoum. Flew Filton-Rome direct because of bad weather at L.A.P. Returned *via* L.A.P. (36 hr 53 min).

In addition, with the agreement of A.R.B., a number of local flights to complete some outstanding test work were carried out as part of the route-proving programme. These, all Filton-Filton flights, brought the total route-proving hours to 262 hr 10 min and the total flying hours completed by G-ANBC to 331 hr 5 min. The last of these flights was made on October 24th.

Sights had been set high for a mid-1955 target: but by July

the 2,000 hr mark had been hit, and the bulk of the C. of A. work completed. The one notable exception to the latter was clearance for "A.R.B. heavy ice"—a commodity hard to come by when deliberately sought, as every flight-test team is frustrated to find. Ice-hunting flights from Entebbe, in the course of which G-ANBC was flown into the severest weather that equatorial Africa could offer, resulted only in light icing, although on one flight the storm warning radar nose—ironically—was damaged by a savage hailstorm. Some icing was unexpectedly experienced during a homeward proving-flight from Johannesburg; this was dispelled by the de-icing system after accruing to 1½in (requirement is for a 3in deposit).

The Britannia's de-icing system is understood to be the only remaining major item to be cleared before A.R.B. certification, and to ensure that at least part of it can be tested to order, G-ANBA is being fitted with a water-spray-rig aft of the wing so that the electrical tailplane system (the wings are hot-air-protected) can be exercised and proved.

To date A.R.B. pilots and observers have flown 100 hr with the Britannia—not a large figure when one considers the magnitude of the task of achieving certification for an entirely new aircraft as large and complex as this one.

Fatigue tests of the structure, the first phase of which—equivalent to a life of 20,000 hr (5,000 reversals)—were satisfactorily achieved in the R.A.E. water tank at Farnborough (*Flight* for July 22nd, 1955). A scatter-factor of, say, six when applied to this figure yields a safe life of more than 3,000 hr. Component-testing has proceeded meanwhile, and the full-scale tank programme will be continued to keep the tank-tested "life" well ahead of hours flown. It is worth noting that, to provide representative data for the Britannia's tank tests, strain gauge measurements of in-flight loads were made in the course of 150 hr flying by G-ALBO. In common with de Havilland and Vickers, Bristol are building their own test-tank, the main structure of which is now complete.

So far as engine development is concerned, no more need be said about the 3,780 e.h.p. Proteus 705 of the Britannia Mk 100 than that it is ready for public service. The engine was in fact cleared for passenger operation last year, and the detailed development work necessary for Britannia certification has been completed recently. Like the Rolls-Royce Dart, unspectacular in performance but with a sound background (40,000 hr) of design and development, the Proteus is likely to do a good job for many years to come.

The scene in the Filton assembly hall is one of heartening activity. Photographs do not adequately record the mind-battering size of the great Britannia hall, or convey the almost clinical neatness of the assembly pattern. Eight Mk 100s, numbers five to twelve, closely follow one another in the race towards completion. Each machine has its target date boldly displayed—e.g., Britannia No. 11, February 1956—while a detailed chart by each keeps check of the progress of every assembly operation. There is now substantial evidence in the nearby fuselage and wing departments to account for all 15 of B.O.A.C.'s Mk. 100s. The aim is to deliver four by the turn of the year, with the others following at close intervals.

Of the aircraft completed, G-ANBA (780 hr flown to November 3rd) is having its ungainly water-spray apparatus fitted; G-ANBB (278 hr) is at Short's in Belfast for final completion; and G-ANBC (331 hr), looking work-worn after its 250 hr of route trials (during which it averaged 7 hr per day), is on overhaul. Production aircraft No. 4, G-ANBD, is on final inspection and engine-runs before first flight. The prototype, G-ALBO (1,144 hr), has been set aside for development of the Proteus 755 (4,120 e.h.p.), power-unit of the 250 and 300 Mks of Britannia. Total Britannia hours to date, including the 51 flown by the second prototype, G-ALRX (dismantled after a forced landing) are thus 2,583.

In an adjoining bay of the great assembly hall is the first Britannia 300—at once distinguished from its Mk 100 neighbours by the added 10ft 3in of fuselage. This prototype is being built to a Ministry of Supply order; the remaining seven 300s, all for B.O.A.C., will be the responsibility of Shorts, the first being due off the Irish line by the end of 1956. The general production programme is distributed between Filton and Belfast as follow:—

Filton: 15 Mk 100 (B.O.A.C.), one 300 (M. of S.), 19 Mk 300 L.R. (B.O.A.C., El Al, C.P.A.L., etc.).

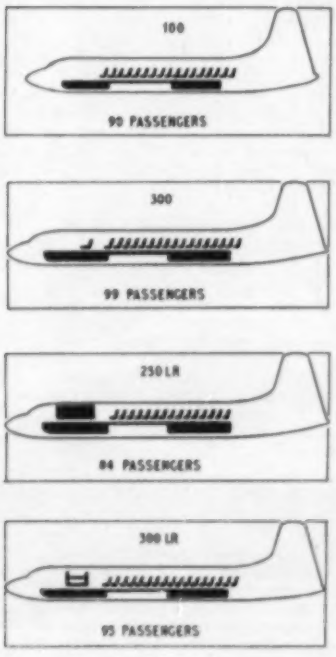
Belfast: 7 Mk. 300 (B.O.A.C.), 8 Mk. 250 L.R. (R.A.F.).

Filton will eventually be left clear to concentrate on building 300 L.R.s—the type for which more commercial orders are confidently expected "very soon." B.O.A.C. will receive their first 300 L.R. from Filton at the beginning of 1957, just as the last of their 300s is due to be finished at Belfast; there may, in fact, be an overlap period. El Al (whose detailed contract specification, unlike B.O.A.C.'s, is already settled) will receive the first of their three 300 L.R.s soon after, if not simultaneously, and C.P.A.L. will take delivery before the end of 1957. It is of interest that current delivery-date for new orders is late 1957.

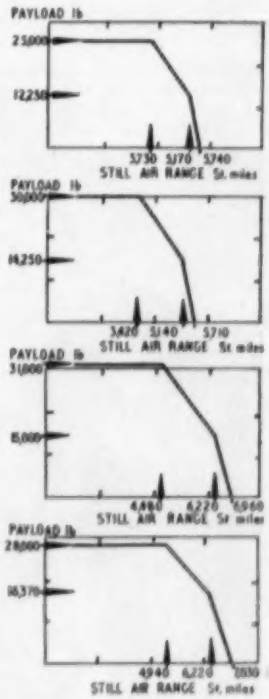
And so to the 64-dollar question: when will the Britannia enter service? Precise information on this point is not easily come by at present—which is understandable, since the answer lies somewhere in the centre of a triangle formed by the A.R.B., Bristol and B.O.A.C. As recently as September it was stated

(*Concluded on page 760*)

BRITANNIA AIDE-MEMOIRE



Gross wt. (lb)	Powerplant	Max. fuel (Imp. gal)	Mean cruise speed (m.p.h.)	Length ft in
150,000	Proteus 705 3,780 e.h.p.	6,670	375	114 0
155,000	Proteus 755 4,120 e.h.p.	6,670	406	124 4
170,000	Proteus 755 4,120 e.h.p.	8,486	406	124 4
170,000	Proteus 755 4,120 e.h.p.	8,486	406	124 4



HERE AND THERE

SLIPPING IN: Taking off from Gros Tenquin, France, R.C.A.F. Sabre pilot F/O. Bob Caskie had his nosewheel seize in its transverse retracting position—without retracting. He informed control, and the operations officer, F/L. Lloyd Skaalan, had the bright idea of getting a fire tender to lay a quick strip of slippery foam. Neat lining up by Caskie did the rest, as shown.

Vampires for Jordan

ACCORDING to an announcement by the Jordan Ministry of Defence, Britain is to supply Jordan with ten Vampires. A Beirut Radio report last weekend said that the aircraft would be flown out to Amman about the middle of this month and that the ferry pilots would stay to instruct Arab Legion pilots. The Arab Legion Air Force is at present equipped only with miscellaneous British transports and trainers.

Vickers Chairman Retiring

FROM Vickers, Ltd., comes the announcement that Lt-Gen. Sir Ronald M. Weeks has decided to vacate the chairmanship on May 31st, 1956, by which date he will have passed the normal age for retirement from executive office in the company. Viscount Knollys, at present deputy chairman, will succeed to the post. A Vickers director since 1953, he was from 1943 to 1947 chairman of B.O.A.C.

Airframe and Engine Strikes

ATTEMPTS to settle the eight-week-old strike of the employees at Hawker's Blackpool factory failed last Friday when a talk between union leaders and company representatives broke down after an hour. On the same day another strike—that at three Rolls-Royce factories in Scotland—entered its second week. This dispute, which is unofficial, has halted production at the company's High Blantyre, East Kilbride, and Hillington factories. Over 700 men have been on strike and 3,750 others have been put out of work.

R-R. Chief in America

LORD HIVES, executive chairman of Rolls-Royce, left on November 4th for the United States, where he is visiting various aircraft companies. It is believed that the Tyne turboprop will be one of the principal topics of conversation.

Proctor to Australia

IN about ten days' time Mr. Keith Martin intends to leave England for Melbourne, Australia, in a Proctor V, flying *via* the Middle East, India, Malaya and Java. He plans to take between twenty and thirty days and has a vacancy for a navigator or passenger. His address is 84 Westminster Bridge Road, London, S.E.1.

The French Mean Business

THE French aircraft industry plans to send six aircraft to the International Fair to be held in Sydney, Australia, from March 19th to April 3rd, 1956. They are: two Nord 2501 Noratlas; one Hurel Dubois H.D.32; one S.O.1221 Djinn helicopter; one S.E. 3130 Alouette II helicopter; and the S.I.P.A. 1000 Coccinelle. On the way to Australia, this contingent will demonstrate at Ankara, Karachi, New Delhi, Rangoon and Djakarta. The French industry, moreover, will be represented at the International Exhibition to be held at Ciudad Trujillo (Dominican Republic) between December 20th and February 27th next.

QUID PRO QUO: American small-aircraft manufacturers often tend to model interiors on car practice; the interior of the Cadillac La Espada, seen at the recent Motor Show, suggests that car makers are reciprocating. Note the central console, carrying air-conditioning louvres and controls, a compass and radio controls. This photograph is from "The Autocar."

Generous Crews

AIRCREWS of El Al, the Israel airline, have subscribed to provide an air passage to New York for Peter Gray, a blind singer and pianist, and have arranged for him to have auditions there. For the past eight years he has been singing at the Palm Court Hotel, Richmond, which is patronized by aircrews of many nationalities working into London Airport.

United DC-6B Lost

THE second serious accident suffered within a month by United Air Lines occurred on November 2nd, when a DC-6B apparently exploded in the air. All 39 passengers and five crew were killed. The scene of the accident was 100 miles south-east of the point—Medicine Bow Peak, Southern Wyoming—where a United DC-4 had crashed with the loss of 66 lives on October 6th. It is reported that an explosives expert has been called in to assist the official investigation into the second accident.

Evening Electrics

A COURSE of post-graduate evening lectures on aircraft electrical equipment is being given at Kingston-upon-Thames Technical College. The course, consisting of approximately 22 lectures by specialists from the industry and from Government research establishments, begins on January 12th. Details are obtainable from the Head of the Engineering Department of the College, at Fassett Road, Kingston-upon-Thames, Surrey.

Dorothy Spicer Essay Competition

MEMBERS of the Society of Licensed Aircraft Engineers, and all licensed aircraft engineers within the British Commonwealth, are invited by the Society to participate in the 1956 Dorothy Spicer Memorial Prize Essay Contest. The organizing committee states that entries will be judged rather for the views expressed than for literary merit. Details from the S.L.A.E. secretary at 1 High Street, Maidenhead, Berkshire.

power in four packages
One big advantage of the Napier Eland propeller-turbine is easy maintenance. Eland power comes in four packages — (1) the reduction gear assembly, (2) the compressor assembly, (3) the main support plate and combustion chamber assembly and (4) the turbine unit. Interchangeability of these major components is catered for, thereby ensuring simple and cheap maintenance.
more facts about the Eland
* High aerodynamic efficiency — 3,000 e.h.p. in a maximum diameter of 36 inches.
* Low specific weight — 0.52 lbs./e.h.p.
* Low specific fuel consumption — 0.450 lbs./e.h.p./hr. at 36,000 ft. 400 knots cruising. 0.505 lbs./e.h.p./hr. at 20,000 ft. 350 knots cruising.
* Ease of control — single lever control with manual over-ride, guards against engine overspeeding and overfuelling.
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* At the first attempt the Eland has recently passed a 150 hour type test rehearsal at the full 3,000 e.h.p. rating.
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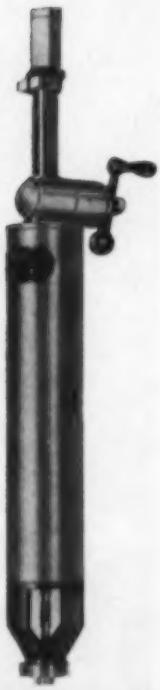
Hup! two three, said the Managing Director. You can keep your Belgian FN's and what-not—the Desoutter Light Horse is now re-equipped with my own Secret Weapon—the new Rackfeed Drill with Bayonet Nose Attachment. On the command One! press the bayonet nose home firmly in the jig bush. Two! a quick half turn to lock it into place. Three! rotate the little handle smartly—and Fire! The Rawest Recruit can drill a whacking great hole bang on target through steel umpteen inches thick, with no Fatigue at all, cookhouse or otherwise.*

Get out of the Awkward Squad! Join the ranks of the Rackfeed Drillers! Demonstrations gladly arranged on your own Company Parade Ground.

**In fact with finger pressure only the Rackfeed Drill will apply a load of 250 lbs.*



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SIKORSKY S-58

An Important Contender for the Civil Helicopter Market

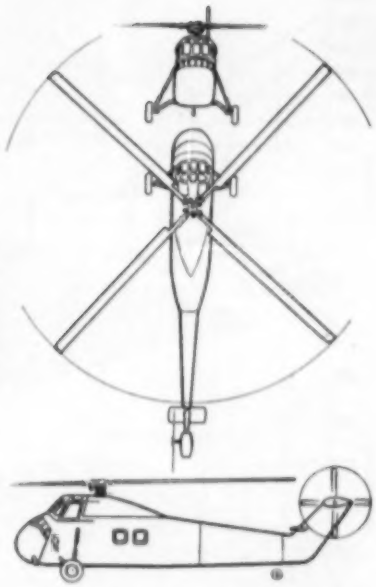
EVER since Igor Sikorsky's pioneering experiments with the VS-300 helicopter, the firm which bears his name has remained faithful to the single-lifting-rotor layout, with mechanical drive. The first big-production design was the S-51; from this grew the widely used S-55, the very large twin-engined S-56 and the S-58. The last-named, which is in its essentials a "stretched" S-55, was first developed as an anti-submarine aircraft (designated HSS-1) for the U.S. Navy, and it is now being delivered in numbers both to that service and to the U.S. Army (who know it as the H-34).

Compared with the S-55, the S-58 is roughly 50 per cent larger, twice as powerful and capable of operating with more than twice as much useful load. It is, however, essentially simple and conventional, and has already reached a very high state of development. Its appeal to civil operators is, therefore, exceptional, and Sikorsky have accordingly prepared a commercial transport version. This aircraft is now in the market for any purchaser with £100,000 to spend, and orders have already been placed by such well-known operators as New York Airways and Sabena.

Power is provided by a Wright (Lycoming-built) single-row Cyclone C9 (military engine, R-1820-84), which delivers 1,525 h.p. for take-off and has a rated output of 1,275 h.p. at 3,500ft. It is installed in the extreme nose at an inclination of about 30 deg, and is covered by two nonstructural clamshell-type nose doors (picture, *Flight* of September 16th last, p. 490). From the rear of the engine the inclined drive is taken up to the intermediate gearbox, and to the main rotor and tail-rotor gearbox. Sikorsky are justifiably proud of the S-58 transmission, which employs 25 per cent fewer parts than are used in the transmission of the S-55. Accessory drives from the transmission are provided for a generator and its cooling blower, for the hydraulic pumps for the primary servo controls and the hoist, and for the rotor tachometer. The clutch is of a new, hydraulic pattern, and it permits protracted engine-running at any r.p.m. with the rotor disengaged.

The main rotor employs four, fully-interchangeable, all-metal blades and has a diameter of 56ft. The hub is of typical Sikorsky design, although it is a much more massive unit than that of the S-55. Great emphasis has been placed upon reducing complexity, and in providing for long life and easy maintenance. The blades, which are of symmetrical N.A.C.A. 0012 section, are free to move about vertical and horizontal axes, and have good all-round performance over a wide range of operating conditions. The tail rotor also employs four, free-flapping, all-metal blades.

Fuselage structure is a conventional semi-monocoque box, forming an unrestricted hold 13ft 3in long, 5ft 3in wide and 6ft high from floor to ceiling. The flight deck is superimposed on the remainder of the structure, and the rear part of the pilots' compartment can readily be removed to provide access to the main gearbox and flight controls. The rear 10ft of the fuselage (which is swept up to form a stabilizing fin) can be folded forward against the remainder of the structure, thus reducing the hull length to about 37ft (this feature was originally incorporated to ease stowage problems aboard carriers with the HSS-1, but it is being retained on H-34s and S-58s). There is also a small fixed, stabilizing tailplane.



General arrangement of the S-58. Fuselage overall length is 47ft 2in and width 5ft 8in. Main rotor diameter is 56ft.

Rather contrary to the general trend, Sikorsky have rejected their previous nosewheel-type undercarriages in favour of tailwheel assemblies. The S-58 employs a simple main gear, with drag struts hinged to rotate about a transverse axis, the vertical loads being taken by long oleo-pneumatic shock-struts attached to one of the main upper longerons on each side. Toe-operated brakes are provided. The tailwheel can caster freely, but is self-centering and has an anti-swivelling lock.

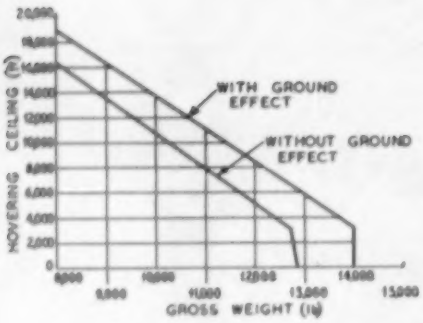
The flight deck is comfortably laid out for two, the pilot normally sitting to starboard and separated from his companion by a large console for radio and other controls. Red lighting of instrumentation is provided for night flying. All round the cockpit are large, sliding, jettisonable windows. Primary flight controls are of the fully powered type, there being two, independent hydraulic servo systems operating both the azimuth (cyclic) and collective-pitch controls. A further hydraulic servo is claimed to "eliminate control forces" in the linkage to the tail-rotor pitch, and the main control column can be trimmed stick-free in any flight condition by a spring-loaded centering device.

Electrical power is generated as 24-V D.C. by a 200-amp generator; it is stated that all main distribution cables can be inspected without prior removal of panels or cowling. Electronic equipment is contained in an *ad hoc* bay under the main cabin floor, forward on the port side. Fuel is contained under the floor of the main cabin, in neoprene-impregnated nylon cells holding a total of 183 Imp. gal. Additional fuel, for ferrying purposes, can be gravity-fed from auxiliary tanks in the cabin itself. Standard equipment includes a 600-lb utility hoist, and the fuselage structure makes provision for the employment of a 4,000 lb automatic ground-contact cargo sling.

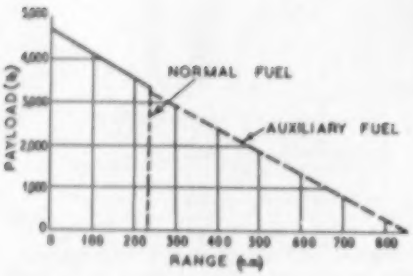
Most of the critical structural or transmission components of the S-58 owe much to experience gained with the S-55, and in some cases the new machine has a directly scaled-up S-55 part. As a result, very competitive overhaul lives are being quoted, 480 hr being the ruling figure for the rotor head and all units of the main transmission. It is hoped that, by the beginning of 1957, this will have risen in stages to 750 hr, and at least 1,000 hr can be seen as the ultimate life; the main rotor blades are to have a minimum life of 2,000 hr. As a guide to spares requirements, Sikorsky suggest that, for an operator using three to five S-58s, spares should include two clutch assemblies and one complete set of transmissions, rotor heads and blades—a total investment of something under 25 per cent of the cost of a complete machine. It is suggested that a spare engine is preferable, and that a second main rotor head should be stocked when more than five machines are in use.

Performance details are given in the small panel of data on

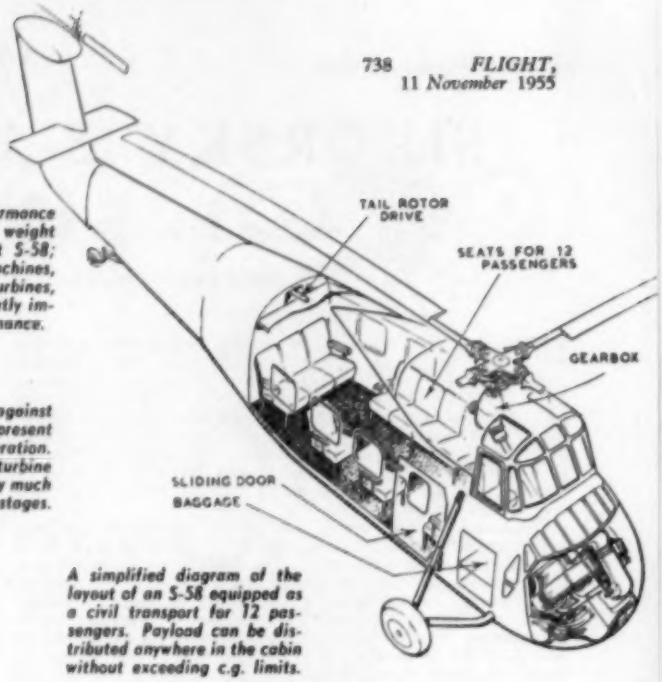
Seen here in H-34A form for the U.S. Army, the Sikorsky S-58 series is unusual in these times in having a tailwheel-type undercarriage.



Hovering performance plotted against weight for the present S-58; developed machines, with twin turbines, would have greatly improved performance.



Payload plotted against range for the present S-58 in civil operation. Later twin-turbine S-58s would carry much more on short stages.



A simplified diagram of the layout of an S-58 equipped as a civil transport for 12 passengers. Payload can be distributed anywhere in the cabin without exceeding c.g. limits.

SIKORSKY S-58 . . .

this page. Sikorsky have calculated direct operating costs, assuming American domestic operation, with fuel at $0.27 per U.S. gal (85 U.S. gal/hr), depreciation over five years at 2,000 hr per year, pilot's salary $8,000 p.a. for 800 hr flying, and 10 per cent hull insurance. The total d.o.c. can then be summated in the following costs in dollars per hour: fuel and oil, 25.19; maintenance and service, 21.2; replacement parts, 8.50; depreciation, 20.0 (aircraft), 14.0 (major spares); pilot, 10.0; insurance, 14.50. Total d.o.c. per hour is thus reckoned at $113.39 (£40). On 15-mile blocks, a 90-knot cruise is calculated to make good a 73-knot block speed; thus, cost per mile becomes $1.35 (9s 6d). Net payload for 150 statute miles, with reserve, plus 350 lb allowance for furnishing and special equipment, is assumed to be 3,450 lb; thus, the final c.t.m. is calculated to be $0.78 (short tons) or 6s 3d per long-ton statute-mile.

These figures are based on a maximum weight of 12,600 lb, of which 5,070 lb is useful. From the start of design on the S-58, an ultimate maximum weight of 15,000 or 16,000 lb has been envisaged; and, in fact, the transmission and control system is stressed for the higher weight. Last week the permissible maximum for the commercial S-58 was raised to 13,000 lb, but further increases will probably have to await the availability of increased power. Sikorsky have stated that the gas turbine—presumably the free turbine—is an "ideal" helicopter power-plant, and the company have a twin-turbine S-58 in the preliminary design stage. Engines of the same power (800 s.h.p.) as the Lycoming T53 would suit the aircraft well, and Sikorsky have stated the relative ease with which the usable fuselage volume could be increased to match the revised weights.

At present the purchase price of an S-58 is estimated at $250,000 (£90,000), exclusive of spares. The first order was placed in October, and called for seven, costing $2m, to be delivered to New York Airways—for many years a satisfied operator of the S-55. Sabena are reported to be in the process of working out an order for eight, and 42 others are at present being negotiated in orders with four non-American operators. India, for example, are reported to have asked Sikorsky to dispose of their S-55s (bought last year) in order to assist the purchase of S-58s. Next year a number of orders are expected, including one from Los Angeles Airways.

Delivery dates up to almost one year from the date of ordering are being quoted. The main plant of Sikorsky at Bridgeport, Conn., is devoted exclusively to S-58 manufacture (at present entirely for the U.S. Services), other types being made at the new facility at Stratford, a few miles away.

It should also be remembered that Westland Aircraft are Sikorsky's chief licensees, and have long shown considerable interest in the S-58. At present there are no firm plans for manufacture of the S-58 at Yeovil, but a project is in existence for an Anglicized development incorporating a number of notable differences. Should there be a requirement, the Westland plant are quite capable of going ahead with the development and production of this machine.

DATA

SIKORSKY S-58 (at 12,600 lb original limit), powered by one Wright Cyclone C9 of 1,525 max. h.p.:—

Dimensions: Rotor diameters, main 56ft, tail 9ft 4in; fuselage length, 47ft 2in; stowage length with tail folded, 37ft; fuselage width, 5ft 8in; overall height, 14ft 2in; undercarriage track, 12ft; maximum fuselage depth, 10ft 6in.

Weights: Empty with standard equipment, 7,530 lb; optional equipment can include radio (90 lb) and 12 commercial-type seats (157 lb); useful load, 5,070 lb; maximum weight, 12,600 lb (since raised to 13,000 lb).

Performance: Maximum sea-level speed, 132 m.p.h; cruising speed, 104 m.p.h.; maximum climb at sea level at rated power, 1,100 ft/min; vertical s-l climb on take-off power, 450 ft/min; hovering ceiling at t-o power, 2,500ft without ground effect, or 7,000ft with ground effect; cruising consumption, 82 gal/hr; range with normal reserves, 270 st.m (ferry range with auxiliary fuel, over 972 st.m).

THROUGH THE SEA BARRIER

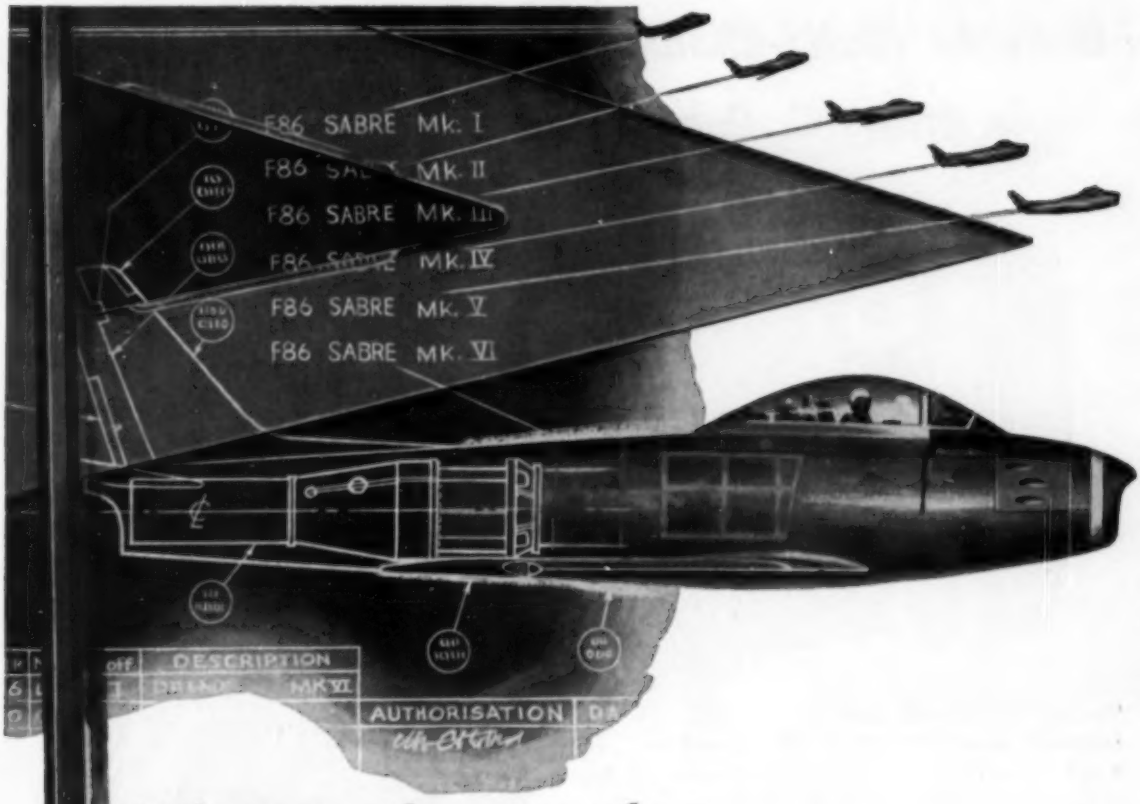
NEWS of an idea for a flying submarine has been released by All American Engineering Co., of Wilmington, Delaware. So far only in the "thinking stage of development" the design would take the form of a hydro-ski-delta, powered by a jet engine for flight and a marine engine driving a small screw for underwater propulsion. The latter would be started before alighting on the sea, and the jet engine stopped after the craft had finished aqua-planing on its hydro-skis. The air intakes and jet pipes would be sealed, water ballast taken on, and the craft then submerged under the power of its marine engine.

Underwater control would be by the flying control surfaces. To surface, the ballast tanks would be filled with compressed air and the marine engine would be cut and its screw retracted; a hydro-ski take-off would then be made under the power of the jet engine. Armament would comprise two torpedoes as well as aerial weapons.

GUIDED-WEAPON SHIP WITH U.S.N.

AS we reported on January 18th, 1952, the former U.S. Navy heavy cruisers *Boston* and *Canberra* (both originally of 12,800 tons) were taken from "mothball" storage for conversion to guided-missile armament. The first-named vessel is now complete, and will be recommissioned next month. The *Canberra* will rejoin next spring.

Both ships have been greatly modified. *Boston* now has but one funnel, and her after 8in turret has given way to a pair of twin launchers for Convair Terrier missiles. The Terriers are stored in two magazines; and early-warning, tracking, loading and firing are completely automatic, a great mass of electronic gear having been installed for this purpose. The four Terriers of each salvo can be rippled away automatically in 0.8 sec, and the launchers can be reloaded approximately every half-minute. Range is quoted as 20 miles. The rebuilt ships will probably be used for task-force protection.



Whatever the aircraft . . .
Development counts at **CANADAIR**

It was recently announced that the latest Canadian-built F86 Sabre jet fighter can fly faster and climb higher than any other aircraft in European squadron service . . . practical evidence of Canadair's superior development and production facilities.

This is the sixth version of this famous fighter which has been produced continuously at Canadair without interruption of scheduled delivery dates. The outstanding record of the Orenda-powered Sabre VI can be credited to the intricate re-engineering of the airframe to take full advantage of the aircraft's new power plant — the Canadian Orenda 14.

In this job, as in the work now going on at Canadair to design and produce the CL.28, a maritime reconnaissance version of the Bristol Britannia, the RCAF depends on the imagination and "know-how" of Canadair's engineers. Like so many aviation experts around the world, they know that in every aspect of production, "You can count on Canadair".

European Representative: J. H. Davis, Princes House, 190 Piccadilly, London, W.1., England.

C-L

CANADAIR

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Marconi Multi-Channel VHF Aircraft Communication Equipment

TYPE AD 115

The type AD 115 equipment is a remotely controlled transmitter/receiver which provides:

- 140 transmission and reception channels, 100 kc/s apart, in the frequency range 118-132 Mc/s.
- Transmission and reception on same or different frequencies.

Features include

- Direct reading frequency scales on the controller to ensure rapid channel selection.
- No valves or crystals in the controller.
- High powered transmitter provides 12-20 watts output power throughout the band.
- Special crystal economiser circuits which enable 24 crystals to provide 140 channels.
- Efficient squelch circuit to eliminate receiver noise when no signal is received.
- Full metering facilities for stage checks to enable rapid servicing.
- Accessibility of sub-assemblies.

The equipment consists of main transmitter/receiver unit and one of two types of controller unit, according to the method of operation. The main unit (left) is built up of receiver, drive, transmitter and power sub units. On the controller unit (right) the required channel is selected by the operation of two switches which actuate an automatic switching device.

More than forty Airlines and twenty Air Forces fit Marconi air radio equipment. Marconi airport installations are in use throughout the world.

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Airport and Aircraft Radio Systems

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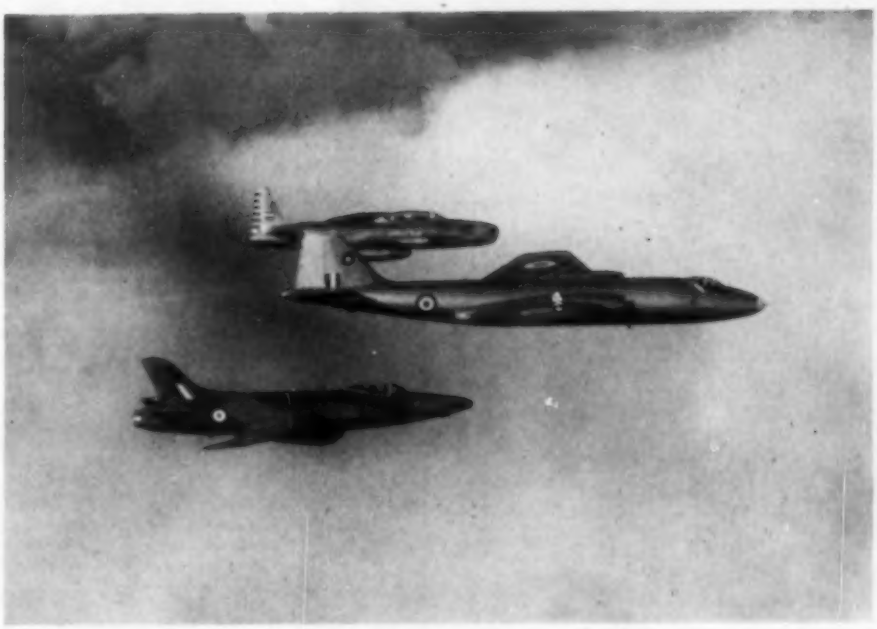
RECONNAISSANCE SYMPOSIUM

"Photo Facsimile" is Introduced at München Gladbach

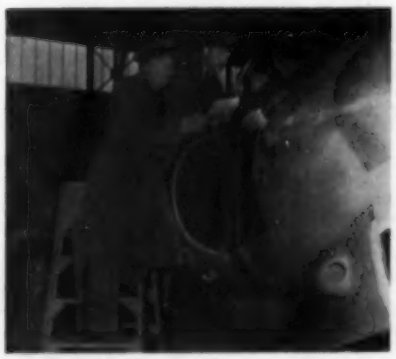


A Canberra P.R.7, Swift F.R.5 (nearest camera) and a Dutch RT-33A symbolize NATO co-operation.

FROM the 3rd Central Region Reconnaissance Symposium, which ended at München Gladbach (Headquarters of Northern Forces Central Europe) a few days ago, emerged the new term "photo facsimile," a process which uses the principles of television. An officially approved statement remarks that, although electronic work has been in progress for some years with a view to cutting down the delays between the taking of reconnaissance photographs and the reception of the information by the striking force, it has only now been admitted by Service chiefs that photo facsimile is "imminently practicable."

The symposium was attended by a hundred delegates who saw a practical demonstration of the equipment, a certain amount of which has been tested in recent exercises. This equipment makes it possible to relay a photograph almost instantaneously from one station to another, either by land line or radio. It is admitted, however, that there is still a long way to go before "the real answer" is found. This would be something along the lines of T.V. cameras in reconnaissance aircraft transmitting their target information to the viewing screens of a bomber force following them up.

Delegates to the conference were told that great progress had been made in the photo-reconnaissance coverage of AAFCE, which now extends over the whole of Western Europe from the Baltic to the Mediterranean. This improvement was due largely to inter-nation agreements between NATO countries and the introduction of new types of aircraft—the Martin RB-57 Canberra and Republic RF-84F Thunderflash of the U.S.A.F., the English Electric Canberra P.R.7 (stated to carry seven cameras)



Above, Col. T. D. Brown, head of the Reconnaissance Division at H.Q. AAFCE, and Col. L. Curry, also of AAFCE, inspect a Swift F.R.5. On the right, delegates to the symposium inspect the camera equipment of a Canberra P.R.7. Left to right, they are: Col. T. D. Brown, Capt. L. Krees, R.N.A.F., Cpl. L. L. Magee, S/L. G. G. Thomas, S/L. S. R. Walton, Command Photographic Officer 2nd A.T.A.F., and Col. L. J. C. Lecerf, AAFCE.

RECONNAISSANCE SYMPOSIUM . . .

and — latest of all — the Vickers-Supermarine Swift F.R.5.

Also apparent is a new trend in P.R. methods. Pilots, it is disclosed, are no longer always instructed to let their cameras "run free" while they are over enemy territory, but rather to photograph the target area only. This, together with increased selectivity in the processing units, considerably reduces the time delay between the landing of the aircraft and the arrival of target information at the intelligence centre of the striking force. The principle of reconnaissance is now such that in the face of modern weapons a few photographs of the right area at the right time can be worth more than the 120,000 required for the launching of the final offensive in Italy.

The official statement continues: "Progress is also being made in the problem of bad weather. It has been worked out that daylight photography is limited to one-sixth of the month because of bad weather, but that the period for night photography is considerably longer. There is, therefore, a new emphasis on the development of night reconnaissance and the subsequent use of flares."

The chairman of the conference, A. Cdre. P. G. Wykeham-Barnes, Assistant Chief of Staff, Operations, at Headquarters, AAFCE, Fontainebleau, commented on the excellent co-operation of members of the symposium, and the enthusiasm which was indicated by observers from other countries. He added that it highlighted the conception of NATO's success in all fields.

The statement earlier referred to is the first official intimation that Swift F.R.5s are now in service. Powered with a reheat Rolls-Royce Avon, this mark of Swift carries nose-mounted cameras and is armed with two Aden guns. Internal fuel capacity is supplemented by a 220-gal tank beneath the fuselage.

Another view of the composite reconnaissance formation wherein the plan form of each aircraft (particularly of the Swift F.R.5) is seen to advantage. The RT-33A is a comparatively little known type and has only recently been introduced into Europe. It carries four cameras and a wire recorder and is a direct development of the T-33 trainer.

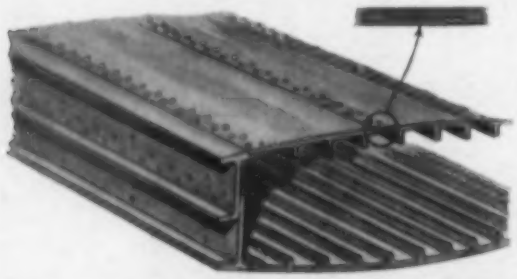
THE ELECTRA'S STRUCTURE

SINCE the description of the Lockheed L.188 Electra which we published last week went to press, certain additional details of the structure of this aircraft have become available. According to *Aviation Week*, Lockheed have taken great pains to evolve an airframe with fail-safe characteristics, i.e. so to design the structure that, if any member were to fail, the remaining local structure would be capable of carrying all normal flight loads.

It is stated that this principal has been "fostered and encouraged in a personal crusade by a few men in the industry. Most of the credit for leading the crusade goes to Richard V. Rhode, of the executive staff of the N.A.C.A."

As described last week, the Electra wing is a relatively straightforward box, with two main spars which are machined, extruded webs stiffened by vertical sections riveted on at frequent intervals (see inset diagram). Both upper and lower skins are machined from large slabs of high-strength light alloy to form integrally stiffened panels. In conformity with the fail-safe precept, these panels are limited to a chord of 20 inches; adjacent panels are lap-jointed and attached by a double row of flush rivets, the panel depth being sufficient for proper machined countersinking. As a result, any crack appearing in a skin panel is confined to that panel, the remaining skins being quite capable of handling the flight loads alone (upper skin in compression, lower in tension).

Even the spars are not continuous over the full depth of the wing, although it will be noted from the sketch that the caps of the spars do form the local wing surface, so making for a section modulus of high efficiency. Each spar consists of upper and lower portions, riveted together along a lap joint. It seems to be Lockheed's intention to enable either the upper or the lower half of the spars to function independently (at least in 1g flight) in the event of failure of the other half. This would seem to be a difficult target, bearing in mind the wing loading of up to 85 lb/sq ft and the very restricted depth of the high-speed section employed.



Detail of the Electra wing, showing the manner in which both spars and skin are made in sections separated by crack-stoppers.

In the fuselage an even more unusual formula has been chosen. The basic structure of the pressure hull is a fairly conventional circular-section assembly of transverse rings (of 136in outside diameter) and longitudinal stiffeners, but on to this is riveted an over-all grid of sheet metal, inside the final skin. This grid is riveted to the skin over the entire area of the latter (except for regions of insignificant stress, such as the nose) and forms a crack-stopping network. It also carries some of the flight and pressure loads and thus reduces the stresses borne by the skin.

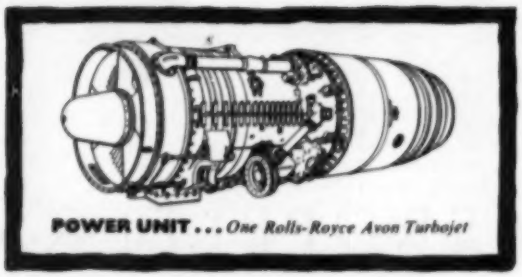
In our description we commented on the fact that the 12-step integral stairway was housed in an unpressurized box, the outer door (the lower portion of which is part of the stairway) taking only aerodynamic and inertia loads. The box is formed by a pair of structural semi-bulkheads, and the inner wall incorporates a strong frame for the pressure-bearing entrance door (see large cut-away drawing published last week). The other doors, such as those for emergency exit at the rear and to provide access to the underfloor holds, are structural and pressure-bearing.

Curiously, the windows are not of the optimum form which Bristol have developed for a pressurized, circular-section hull; they are not even simple ellipses. On the other hand, Lockheed emphasize that the straight sides are joined by generous radii at the corners, and the resulting design is claimed to give a low operating stress and to fit in well with the general fail-safe precept.

* * *

Although not directly connected with structural considerations, it is apposite to note a change in Lockheed thinking with regard to the flight-control system. Originally, the Electra was to have used a manual, aerodynamically boosted system for all primary control surfaces. The latest reports on the aircraft speak of a fully-powered system, with duplicated hydraulic actuation. If this is indeed so, it marks an unexpected failure on Lockheed's part; on the other hand, it may be that powered controls will be required only for the C.A.A. tests.

THE *FAIREY* DELTA 2



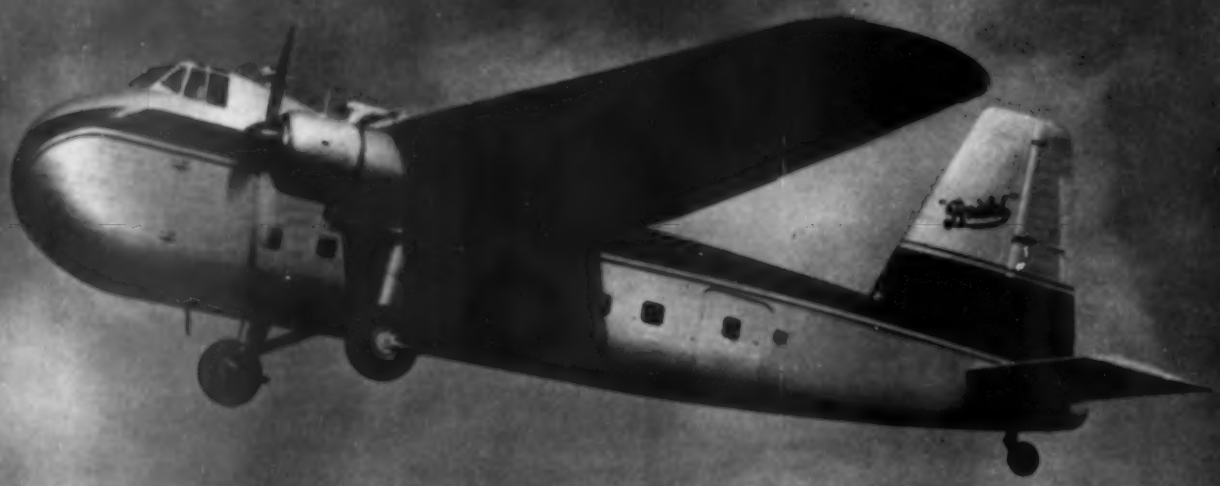
POWER UNIT . . . *One Rolls-Royce Avon Turbojet*

How to go faster: the basic unchanging problem of aircraft design. Mach 1 is no longer the target; but higher Mach numbers present entirely new obstacles. The Fairey Delta 2 will play a part in the investigation and solution of these problems at newly-attainable speeds, showing the way to aircraft for the future needs of N.A.T.O. and the Western world.

THE FAIREY AVIATION COMPANY LIMITED · HAYES · MIDDLESEX

1,600 hours between overhauls

The overhaul life of the de Havilland propellers for the Bristol Freighter Mark 21 has been increased to 1,601 hours. Propellers on these aircraft have now amassed half a million hours of satisfactory service.



DE HAVILLAND PROPELLERS

"The Aeroplane" Photograph

Seen in its "anti-atom" finish, the Convair B-36 on the left was photographed recently over Kent. A B-36 reconditioning and modification programme is now under way at Convair's Fort Worth plant. Seen below in the new U.S. Navy colour scheme of grey and white is a Chance Vought F7U-3M Cutlass. The missile launchers are clearly seen under the folded outer wings. Note also the slots.

AIRCRAFT INTELLIGENCE

Great Britain

Mixed-Power Intercepters. It is reported in Italy that two mixed-power intercepters —one a Saunders-Roe, the other an Avro— will soon make their first flights. One of these machines, it is said, will have a de Havilland Gyron or Gyron Junior and a Spectre, whereas an Orpheus and an Armstrong Siddeley rocket are specified for the other.

U.S.A.

Piasecki YH-16A. Since this, the world's largest helicopter, was illustrated in *Flight's* special Philadelphia Show reports (September 16th and 23rd), the tail has been completely revised, now having anhedral horizontal surfaces and vertical fins at the extremities.

Fairchild C-119 Flying Boxcar. The last machine of this type—the 1,112th—recently left the Fairchild production line at Hagerstown, Maryland.

Bell Helicopters. Three gas turbines are the intended powerplants of a 28/36-passenger transport development of the Bell HSL anti-submarine helicopter. Present powerplant of the HSL is the Pratt and Whitney R-2800 piston engine. Troubles continue to be encountered with the anti-submarine version. Rotor blades of larger diameter are to be fitted.

Boeing KC-135. It is intended that this tanker equivalent of the 707 transport shall have a starter on only one of its four turbojets. The other three will be started by compressor-bled air from that engine blown into the intakes, thus saving space and weight.

Hiller Rocket Helicopter. The destruction by accident is reported of a recently completed Hiller helicopter developed from the Hornet but with the ramjets replaced by "oxygenated water rockets." Additionally there was a small piston engine mounted in the fuselage and driving a propeller. The machine is reported to have climbed vertically with the rockets and to have flown horizontally as an autogiro. It is surmised that "alterations of dynamic stability and insufficiency of directional control" may have been the causes of the accident.

Boeing KB-50. One hundred Boeing B-50 bombers are being converted by the U.S.A.F. into KB-50 three-point tankers. They will be employed by Tactical Air Command, T.A.C. having long stated a requirement for multiple-point refuelling for its fighters and fighter/bombers. Hitherto, KB-29s, equipped with the Boeing flying-boom system, have served. Aerodynamic improvements will add a few knots to cruising speed.

Strouhoff MS-8-1. This designation denotes a forthcoming development of the Avitruc. A "pantobase" transport, it will have turboprop power and boundary-layer control.

France

Nord 1500 Guepard. The name Guepard (Cheetah) has been conferred on the Nord 1500 experimental delta-wing fighter, which made its first flight from Melun/Villaroche on September 20th. Officially admitted to be "characterized by two sorts of powerplants," the Guepard is understood to have a turbojet arranged along the axis of a ramjet.

S.E.210 Caravelle. The latest price unofficially quoted for this twin-Avon transport is $1,857,000 (approximately £664,000). During October the machine was inspected by—among others—Alexander Kartveli and officials of the Republic organization; directors of U.A.T.; Messrs. Gray and Campbell Orde, respectively of the M.o.S. and B.O.A.C.; and Dr. Kimura, technical adviser to Japan Airlines.

S.N.C.A.S.O. Vautour (Avons). As reported in *Flight* of October 28th, a Vautour all-weather fighter has been fitted with two Rolls-Royce Avon RA.41 turbojets. The thrust of this Avon is now given as 9,925 lb, and it has been disclosed that the particular Vautour is No. 09, one of the six pre-production aircraft being delivered this year. Together with the three prototypes, these machines will serve for operational development work. It is officially stated that, while endurance tests and armament trials with bombs, guns and missiles are being effected with the other prototype and pre-production aircraft, No. 09 will "contribute practical information on the behaviour and performance of the Vautour airframe equipped with high-thrust engines." Deliveries of Vautours to the French Air Force will begin in the spring of 1956, but all these machines will be powered by S.N.E.C.M.A. Atar 101E3 turbojets of 7,720 lb thrust.

Potez 75. Having undergone gunnery tests at Cazaux, this twin-boom pusher left Les Mureaux recently for tests in North Africa. The aircraft is now equipped with four machine guns and has provision for eight rocket projectiles.

S.N.C.A.S.O. Djinn. The first Djinn helicopter to be sold outside France was delivered recently to a Swiss company.

Marcel Dassault Mystère IVA. Some days ago M. Roger Gromand, Assistant Air Prefect, visited the Cambrai base of the French Air Force to witness resumption of flying within the framework of "Operation Cormy." This operation had previously been interrupted as a result of a "jet engine failure." Operation Cormy is described as a stepped-up Service exercise involving all Dassault Mystère IVAs powered with the Hispano-Suiza Verdon turbojet. The first squadron was equipped with these machines at Cambrai in May this year. Principal object of the exercise is to determine requirements in spares, supplies and maintenance of the Verdon-Mystère over a 4,000-hr flying period.

Natural Mode

Vibration as a Tool of the Airscrew Designer

SET a thief to catch a thief is a proverb that can be applied to vibration: the help of this robber of passenger-comfort and structural life can be enlisted to lead to the arrest of general vibration evils.

The airscrew, inevitably perhaps, often tends to be the whipping-boy for aircraft vibration troubles. Weighing as much as half-a-ton and measuring perhaps 16ft in diameter, can it be so perfectly matched to its powerplant, and so daintily balanced inherently, that no out-of-balance forces are present?

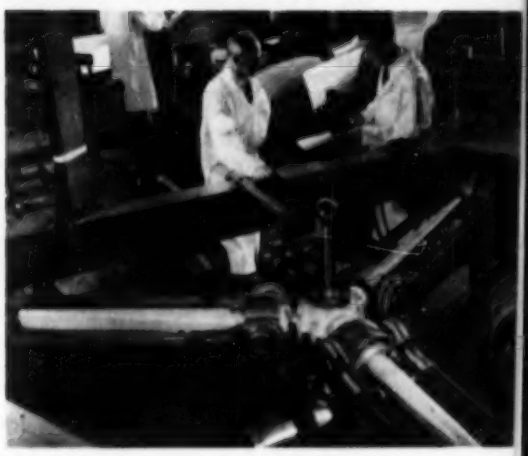
Glimpses of the airscrew's background, in which the greater part of the design and development period is devoted to the mastery and elimination of vibration problems, are provided by the accompanying photographs. Taken in the Hatfield vibration-research laboratories of de Havilland Propellers, they illustrate a stage in the upbringing of a new airscrew—of high-frequency vibration stresses being artificially applied so that their effects can be controlled and examined in the quest for longer life, lower weight, smoother running. Vibration research enables the loads of an airscrew's lifetime to be simulated in the course of a few weeks.

Application of vibration testing in a different sphere—that of airframe structures, by the use of dynamic models—is described in an article on page 755 of this issue.

A Britannia airscrew being prepared for a final dynamic-balance check in the de Havilland test tunnel at Hatfield.

In the control room (below, left) the out-of-balance readings, transmitted from a statically mounted coil on the engine, are being taken. (Below, right) Vibration test to destruction: A pair of hollow-steel blades, cut short after tip-testing, are clamped by their roots and vibrated edgewise. After each session of 100m stress-reversals the blade roots are X-rayed before the test is continued at a higher stress until fatigue failure occurs.

(Above) A Centaurus piston engine is used for the final dynamic balancing check; all vibration signals in the power unit itself are eliminated by an electrical filter, thus enabling a piston engine to be used for the checking of a turbine airscrew.



(Right) Centrifugal force on three-bladed airscrews, which are being vibrated in an axial mode, is simulated by applying an internal hydraulic load to the hollowed roots of each blade. Loads on four-bladed airscrews are applied outwardly by steel hawsers.

(Below) An early test determines the fatigue resistance of the blade-tip. A hollow-steel specimen is vibrated by a large electro-magnetic vibrator in one of its natural modes, and is subjected to some 100m stress reversals in the course of a three-week test.

THE AERONAUTICAL BOOKSHELF

"Pioneer of the Air," by G. A. Broomfield. Gale and Polden, Ltd., The Wellington Press, Aldershot, Hants. Illustrated. Price 10s 6d.

HEAVIER-THAN-AIR aviation, in its 52 years, has bred many "characters"—men who by their deeds, dress or demeanour were regarded, according to taste, as geniuses, heroes or candidates for the nearest padded cell. Surely, of all these "characters," there was never one like Samuel Franklin Cody?

Born in Texas, he spent his early manhood hunting buffalo and fighting Indians, like his namesake "Buffalo Bill" Cody. He then ran a Wild West show (and invented a remarkable "tommy gun") before joining that other character, Col. Templer, at the Balloon Factory, Farnborough, as an instructor in kiting.

Today, the gnarled skeleton of Cody's tree at the end of the main runway at Farnborough reminds us of what followed, of how Cody became the first person to fly in a powered aeroplane in the United Kingdom and of how, four years later, he earned his greatest triumph by winning the Military Trials on Salisbury Plain in his gigantic bamboo and canvas biplane.

What material there is for the kind of glamourized, technicoloured biographical treatment that fills our modern world with larger-than-life heroes! And how good it is, in consequence, to read Mr. Broomfield's simple, unexcited account of the life and death of Cody, who was truly larger-than-life. Nor is it merely the story of the man, for there are valuable tables listing the specification details of every aeroplane he built.

It is doubtful if we shall ever again have such a man in aviation. A dashing figure with a goatee beard, flowing hair, stetson hat and cowboy boots, riding a richly-saddled white horse, would hardly fit the scene at Farnborough today. Nor would Cody have approved of so much science, for his aircraft flew despite the laws of aerodynamics rather than because of them. Yet no pioneer earned greater admiration and affection that this "old man," who was only 52 when he was killed.

"Playground in the Sky" by A. F. "Bill" Gotch. Hutchinson and Co., Stratford Place, London, W.1. Illustrated. Price 12s 6d.

ONE does not expect to find a description of the principle of the turbojet in a book sub-titled "The Art and Joys of Gliding." Not that this is necessarily a disadvantage—it is merely Bill Gotch. His book will offend the aeronautical purist; it will exasperate those who like to stick to the point; and it will bring tears to the eyes of those who seek a logical progression of thought in print. And yet a keen breath of enthusiasm for flying comes bubbling up, thermal-like, amid the irrelevancies and rambling anecdotes—and all is forgiven.

The book is intended as an introduction to gliding, and should certainly attract new recruits to this most exhilarating sport. If they wish to progress seriously, however, they should make sure that their instructor points out which of the book's carefree over-simplifications in particular should be ignored. If they go to Lasham, their instructor may be the author himself, who should know. But dry text-books are out of place in any playground, especially that of the sky, and there is certainly no dryness here. In spite of the author's mastery of non-pertinent story-telling; in spite of his splendid indifference to the demands of order and relevance; in spite of our better judgment—we like this book.

"The Soaring Pilot" by Ann and Lorne Welch and F. G. Irving. John Murray, 50 Albemarle Street, London. Illustrated. Price 15s.

FOR the glider pilot who is at the early-soaring stage of the game and who is looking for food for thought, this book provides the meat. Its object is "to eliminate much of the witchcraft which is often supposed to inform those who attain success in soaring"—not by reducing soaring to a cold, mechanical process, but to assist pilots to enjoy more readily the rewards of the sport. "If this book can be said to have any theme other than the immediately obvious one," the preface states, "it is to suggest that success in soaring and in handling or designing gliders involves working, thinking and taking personal decisions in simple, logical, straightforward and honest ways. In a world which regards a television quiz as a substitute for thought and the uneasy compromise of a committee as a masterly decision, these are valuable abilities . . . "

It is pointed out by the authors that a sailplane is one of the few remaining types of aircraft which can be fully understood and designed by one man, and in the early chapters of the book Frank Irving gives an admirable outline of glider design, performance, instruments, and test flying. The viewpoint is that of a practical pilot with the ability to *interpret* aerodynamics.

"How to soar" might be a simple title for the second half of the book, written by Ann and Lorne Welch. They do not lay down a list of hard and fast rules; instead, they provide a basic understanding of the nature of soaring, of the various factors involved and of the reasons for particular techniques.

No gliding enthusiast will need to be told to buy this book. Copies are in the bar at his clubhouse, and the names of the authors are a sufficient guarantee of the quality of the contents. *The Soaring Pilot*, however, should be read by a wider public. It should be read by power pilots, who will receive not only a challenge and a taste of what they're missing, but also a wiser understanding of the air. And it should be read by some of the many designers and technicians who, through remoteness, are losing their feeling for flying.

"Brassey's Annual, 1955," edited by Rear-Admiral H. G. Thursfield. William Clowes and Sons, Ltd., Little New Street, London, E.C.4. Illustrated. Price 63s.

IN its modern form, *Brassey's* has somewhat limited value as a reference work: but it is immensely entertaining as a paper platform on which senior officers of all three Services, and others, can thump their favourite tubs.

The most significant fact that emerges from this new edition is that the aircraft carrier is riding a new wave of popularity. Even those who were calling a year or two ago for its prompt scuttling, as an obsolete and vulnerable waste of military effort, are repenting.

The case for the carrier is presented admirably in the 1955 *Brassey's* by Rear-Admiral Torlesse. He asserts that the land aerodrome, not the carrier, has become a liability, being easy to find and to hit. His arguments in favour of carrier-based anti-submarine aircraft are irrefutable, and he emphasizes the carrier's usefulness as a mobile base for bomber and ground-attack aircraft. He recalls that out of 229 carriers used by the Allies in World War II, 39 were lost, of which only four small escort carriers were sunk by shore-based aircraft. Of these four, three were sunk by *Kamikaze* attack.

Thirsting for a good fight, we turned to page 149 to read the views of Air Marshal Sir Robert Saundby in his piece on "The Royal Navy in the Atomic Age." Only a year ago, this much-respected strategist wrote*: "The days of the Battle Fleet, whether it be composed of battleships or aircraft carriers, are over, and its place as the backbone of sea power has been taken by shore-based aircraft," and later, "I used to think that, for the next ten years or so, the best defence against submarine attack would be the escort carrier. But two things have recently made me wonder if this is true."

Now, in *Brassey's*, he writes: "I used to think that, in these days of powerful long-range land-based air forces . . . there was no case for spending large sums of money on heavy aircraft carriers. But for two reasons I am now inclined to think that, at least for the time being, there may be a justification for this type of warship."

There is much more to provoke thought and discussion. An Army officer has contributed a well-reasoned paper on "Aircraft as a Means of Army Supply and Reinforcement" and there are two excellent, factual, chapters by A.V-M. Yool on "Royal Air Force Problems" and "The Strategic Air Command, U.S. Air Force." For anybody who does not know S.A.C.'s interpretation of the term "immediate combat readiness," operations described in the latter will seem almost unbelievable.

Unfortunately, the aviation article that should have been most interesting of all, on "Aircraft Development and Production" during the year, is so confused in style and fact as to be almost valueless. Its author must certainly deserve the prize for the understatement of the year in commenting that the English Electric P.1 "is not really a *light* fighter." The italics are not ours.

"The Law of Sea and Air Traffic" by Derek H. Hene. Shaw and Sons, Ltd., Fetter Lane, London, E.C.4. Price 50s.

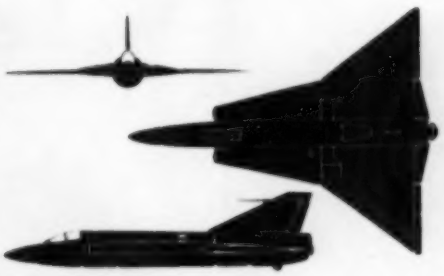
MANY are the parallels—and the discrepancies—between legal decisions involving sea and air transport respectively. A convenient comparative review of essential principles, such as this book contains, is a most welcome addition to the existing specialist literature on air law.

The book will be of most value to men of commerce, exporters and importers, insurers, underwriters and lawyers concerned with the wider aspect of international transport in general, but it provides also a useful source of reference for airline operators and other specialists. Part 1 is devoted to sea traffic law, covering international regulations, British and foreign local rules, and safety regulations. The law of air traffic, in Part 2, begins with an outline of the Chicago Convention and goes on to deal in turn with rules of the air and air traffic control, safety regulations, and national air traffic regulations. A short section on ancillary matters (Part 3) traces the respective regulations concerning radar control, limitation of liability, and accident investigation, for sea and air. The book is supported by an excellent table of cases.

*In "Aircraft Today" (Ian Allan, 9s 6d).

An impressive aspect of the Saab-35 Draken (Dragen), first flown on October 25th at Linköping, by the company's chief test pilot, Bengt Olow.

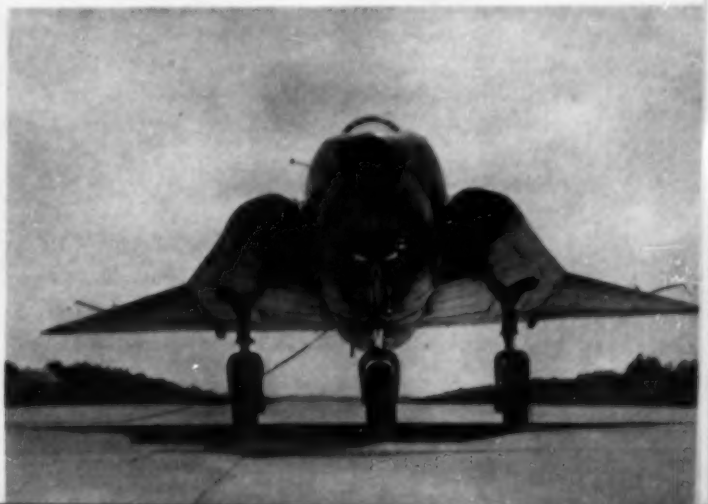
SAAB DRAKEN



IN these times the utmost caution must be exercised in appraising a new aircraft on preliminary, superficial evidence. It is clear, however, that if development difficulties do not exceed the average—and, having regard to the design background, they may well be less—the new Saab-35 Draken (Royal Swedish Air Force designation J35) should prove to be a fighter of outstanding merit. Salient features of the design can be studied in the unofficial silhouette in the centre of the page (acknowledged to our Swedish contemporary *Teknikens Värld*) and clearly much is owed to the Saab-210 research aircraft. The "210" is seen in the views below, which show how the intakes and other features were developed to simulate those finally adopted for the J35. The "210" made its first flight nearly four years ago and the Saab organization is well satisfied with the results obtained. The unique "double-delta" plan form, they state, provides a relatively large space for equipment and fuel, in combination with low weight, low drag, supersonic speed and a high degree of intake efficiency. The fin of the J35—itself approximately of delta form—merges with a spine running forward to the cockpit and housing various controls, which are thus easily accessible. The shapely canopy covers a fully automatic ejection seat of the latest Saab pattern. All flying controls are powered, and synthetic feel is fed to the control column and rudder pedals. The power unit is a reheat Rolls-Royce Avon, soon to be built under licence in Sweden by Svenska Flygmotor AB. The main undercarriage legs have pre-retraction, and a considerable reduction in landing run is effected by the braking parachute contained beneath the fin. There is a built-in gun armament and provision is made for rocket projectiles or air-to-air guided missiles. Electronic equipment is said to allow "all-weather navigation and flying at very high altitudes."

Gradually the J35 will replace the J29 "Flying Barrel" in squadrons of the Swedish Air Force. After preliminary tests by the makers the prototype will be sent to the Air Force Experimental Establishment (Fc) at Malmslätt, prior to being cleared for quantity production. It was designed and built in collaboration with the Royal Swedish Air Board and wind-tunnel tests were made at the Aeronautical Research Institute of Sweden (FFA) at Ulvsunda, the Saab Plant in Linköping, the Royal Institute of Technology (KTH) in Stockholm, and the Svenska Flygmotor AB in Trollhättan. A comprehensive stress research programme was undertaken at Saab, FFA and KTH.

As originally flown (below, left) the Saab-210 Adder-powered research aircraft, from which the J35 has been developed, had very different intakes from those later adopted and seen in the right-hand view. The later intakes resemble those which feed the Avon of the new fighter.



746-747
FLIGHT,
11 *November*
1955

CONTINUOUS PERFORMANCE

THERE is a certain visual satisfaction in the airport scene, with its flat patterns of windswept grass and concrete, enlivened by the sleek, shining forms of transport aircraft. Airliners, painted and polished, are the non-stop performers on this great open-air stage. Audiences are made up of the spectators who crowd public enclosures to watch the exits and entrances of aeroplanes, and to travel vicariously to and from loudspoken destinations. Airport workers and passengers form the supporting cast, too much a part of the play to see it as a whole.

It is a scene subject to dramatic change, according to the time, the place, the traffic and, above all, the weather. All four influences are at work in these contrasting impressions of three major airports.

Schiphol, airport of Amsterdam and gateway to the Netherlands, is seen (left) on a late October afternoon. Standing on the glistening apron, dwarfed by a massive autumn cloudscape, are four inter-city airliners—a B.E.A. Viscount, a Scandinavian Airlines Scandia and two locally based K.L.M. Convairs. Schiphol lies 13ft below sea level and was once part of a lake, the Haarlemmermeerpolder.

The sunny London Airport scene above recalls an uncommonly fine summer, which saw the opening of the new central terminal buildings in the background. Such weather undoubtedly helped to encourage the growth of London's traffic, which reached a record peak of 689 landings or take-offs in one day. Among the most frequent users of this, Europe's busiest airport, are the Viscounts of B.E.A. and Air France, four of which are seen in company.

Finally, a dazzling glimpse of the Lockheed Air Terminal at Burbank. An almost symbolic setting, this, for while a night shift prepares two new Super Constellations for flight-testing on the morrow the floodlit terminal in the background is maintaining the tempo of routine airline schedules. In the far distance are seen the Hollywood Hills, silhouetted against the Californian night sky.

Convair F-102A.

LEAD-COLLISION ATTACK

America's Development of Automatic Interception

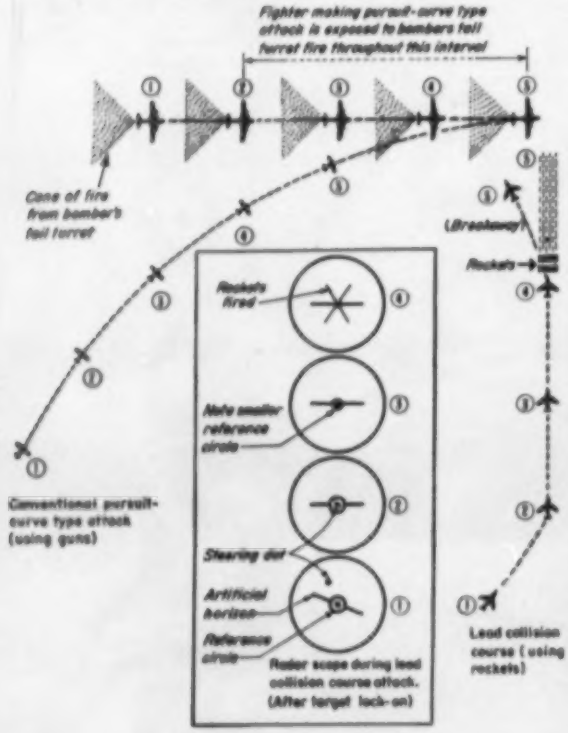
THE weapons system which includes the "lead-collision attack" equipment has hitherto been talked of almost with bated breath and hailed by the publicity-conscious U.S.A.F. as a deadly defence against the bomber. It is without any doubt a remarkable achievement in electronics and armament, but full automaticity and sure-fire accuracy are not yet achieved. The details of the working of present equipment has remained a closely guarded secret, and not many are even now privileged to know the exact working of the system or, more important, its capability defined as a kill-rate. But even as the radar and ballistic rocket fighter is becoming fully established in U.S.A.F. squadron service the more advanced combination of radar and guided missile with remote G.C.I.-controlled aircraft manœuvring is in course of preparation.

The lead-collision system originated in a 1949 proposal for a fighter which could attack a bomber accurately from somewhere abeam, thus successfully avoiding tail armament which was becoming more and more powerful and increasingly accurate. The fighter could no longer afford to creep up to the tail of a bomber with a marginal closing speed and expose itself to the radar-directed automatic fire of two or even four 20 mm cannon. Such armament has now become almost standard in American bombers, and the beam attack is the Americans' own answer to it. The accompanying diagram shows that a fighter following the traditional aiming-off pursuit curve would be exposed to the tail turret for a comparatively long part of its attack. Furthermore, the use of the standard U.S.A.F. 0.5in machine gun requires long steady bursts to have appreciable effect on the strongly constructed jet-bomber airframes of today.

The Hughes Aircraft Company therefore began the development of their fire-control system, and other agencies provided a new weapon in the form of the Mighty Mouse folding-fin rocket. This could be discharged from tubes in external pods or retractable packs. Though the ballistic accuracy of these weapons was not great, they could be easily fired in salvos which gave a shot-gun type spread and therefore reduced the accuracy limitations of the fire-control system. Just one hit was sufficient to destroy a bomber, and the area covered by a full salvo of 24 Mighty Mice was stated to be equivalent to that of an American football field—an area through which it nevertheless proved surprisingly easy for a bomber to pass unscathed. Proximity fuses were not needed since the rocket's effect was small unless it obtained a direct hit. The Mighty Mouse was therefore not an expensive weapon. Another advantage was that the fighter no longer required a great speed margin over the bomber.

Based on the Mighty Mouse rocket salvo, the Hughes fire-control system works in the following way. The pilot is vectored towards his target by G.C.I. in much the same way as for a stern chasing attack, but he is not placed astern of his quarry. The attack can be made theoretically from any quarter at the same height, but aircraft characteristics make a head-on approach rather dangerous and it is the object to avoid stern-chasing. The ideal is 90 deg abeam. The pilot has in front of him, in the centre of his normal blind-flying panel, a radar scope. His aerial is scanning a vertical fan beam backwards and forwards laterally, and the trace of this appears as a fast-moving vertical line on the scope. Superimposed on this presentation is a line resembling in aspect and function the horizon bar of the normal artificial horizon, so that the pilot can fly blind watching the scope alone and occasionally referring to the A.S.I. or other instruments.

At a certain point the target echo will appear as a blip on the screen. Its range and bearing will be indicated by its position on the scope, vertically for range and sideways for bearing relative to the intercepter's centreline. The pilot then locks his aerial to follow the blip only by manœuvring the aerial's search trace by manipulating a handle until the line is stationary across the blip. He then presses a switch on the grip which causes the blip to glow larger. The set is then locked on.


Fighter making pursuit-curve type attack is exposed to bombers tail turret fire throughout this interval
Cone of fire from bomber's tail turret
(Breakaway)
Rockets
Conventional pursuit-curve type attack (using guns)
Rockets fired
Note smaller reference circle
Steering dot
Artificial horizon
Reference circle
Radar scope during lead collision course attack. (After target lock-on)
Lead collision course (using rockets)

The old and the new attacks, as represented in an "Aviation Week" diagram. At left, the "lead-pursuit" curve requires a high closing speed and long firing time and brings the fighter into the bomber's cone of fire a little before reaching position 3. "Lead-collision" tactics on the right show that the fighter does not need a great speed margin over the bomber. At position 5 both aircraft are very close to each other and the fighter is breaking away behind. The scope pictures show the presentation for the corresponding numbered positions along the intercepter's track during an ideal automatic lead-collision course.

The POWER of Armstrong Siddeley

The Fairey Gannet carrier-operated torpedo bomber of the Royal Navy owes its long range and economical cruising to the Armstrong Siddeley Double Mamba turboprop. This unique design provides twin engined performance and safety factor with the fuel economy and stowing facilities of a single engined installation.

ARMSTRONG SIDDELEY

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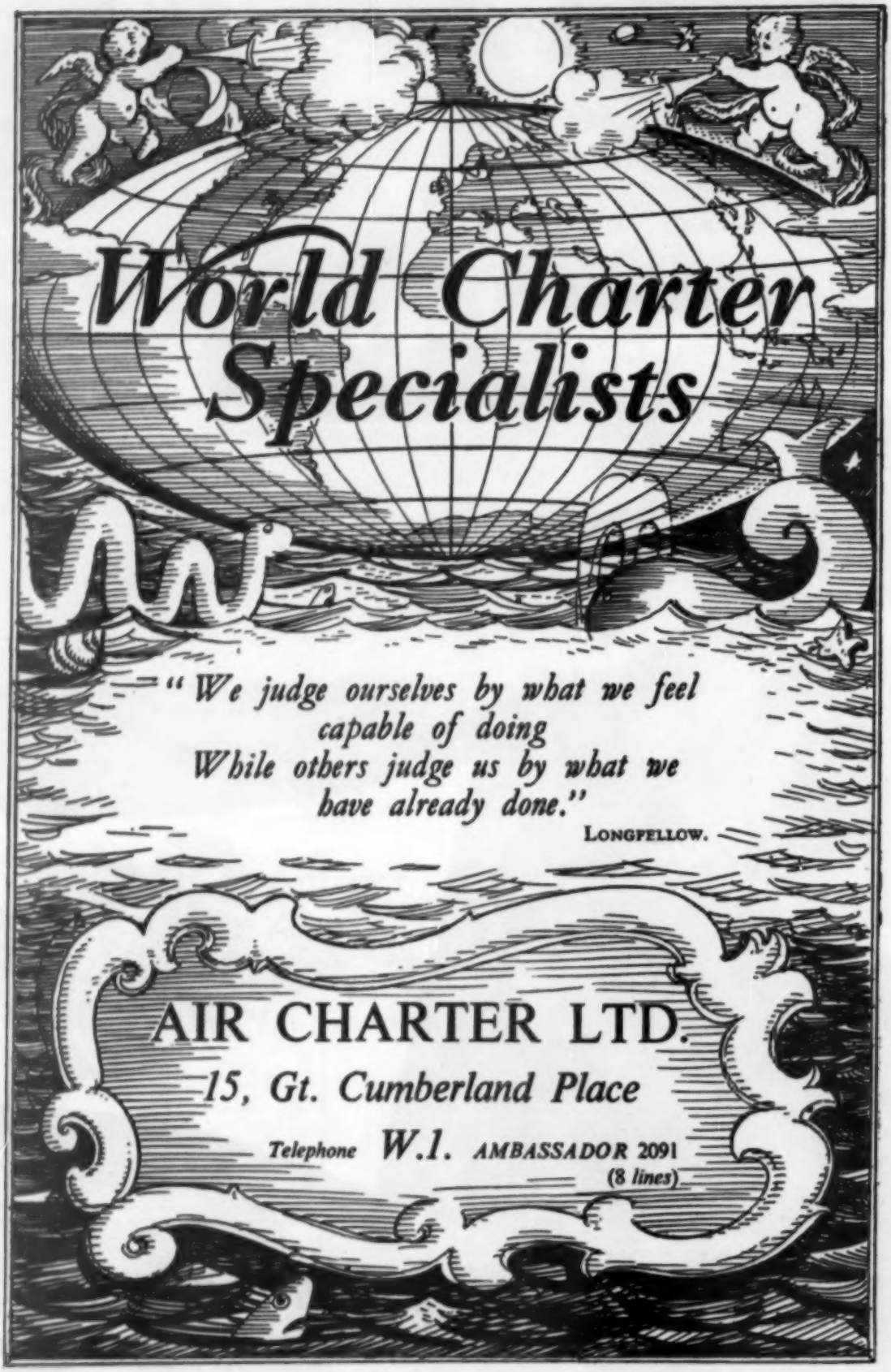
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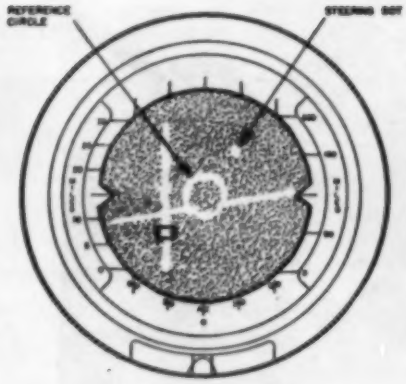
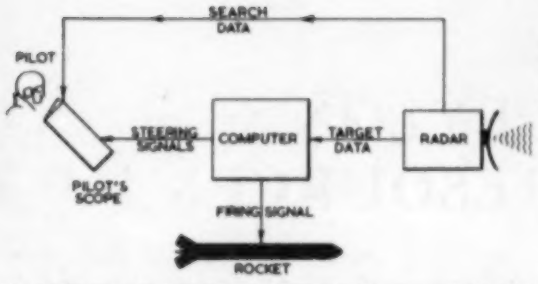
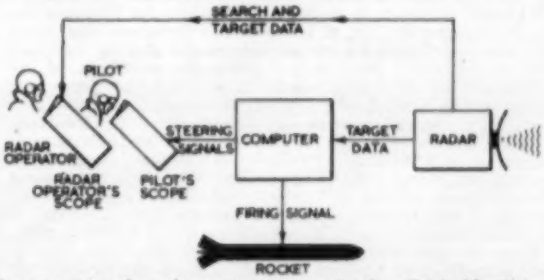


(Left) The pilot's scope presentation after "lock-on." The scanning line is locked to follow the enlarged target trace 30 deg to port and seven miles away. The horizon shows starboard bank as the pilot flies to bring the reference circle up towards the steering dot. A ball slip - indicator below the dial helps the pilot to avoid slip or skid when firing.



The single-seat intercepter's equipment in diagrammatic layout is deceptively simple in appearance, but its bulk and complexity made it difficult to fit into the F-86D while yet remaining accessible.



In two-seaters the radar operator can assist the pilot in identifying and locking on, being able to give his undivided attention to the art of reading the radar scope picture. The R.A.F. will use this system.

LEAD-COLLISION ATTACK . . .

Immediately a ring appears together with a steering dot. The ring will be large in diameter and a break in its circumference will appear opposite the relevant point on a scale round the edge of the scope (not shown in accompanying diagrams) to indicate the rate, in feet per second, at which the intercepter is closing the target. The steering dot will be so positioned on the scope that if the pilot manœuvres the aircraft to bring the dot into the centre of the ring, referring the while to the artificial horizon bar, his course will be correct for eventual firing of his rockets.

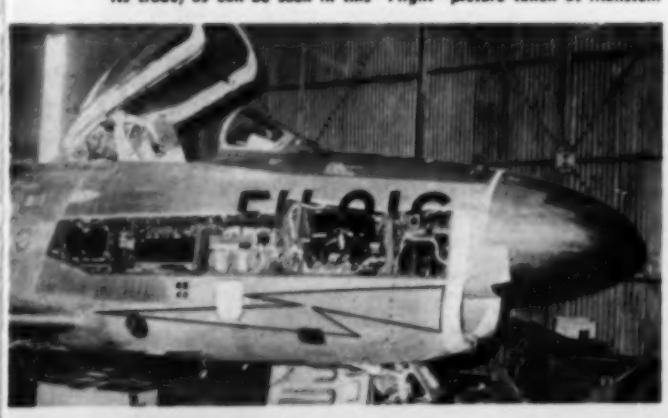
The distance between intercepter and target closes, and when the firing point is 20 sec away, the diameter of the large ring will decrease until it closely surrounds the steering dot. At that point the pilot must fly very accurately as the critical moment of firing is at hand. A little over four seconds short of firing, a signal on the scope tells the pilot to press the firing trigger to arm (but not fire) the rockets. He has already selected the number of rockets he wants to use. At the exact moment the rockets are fired, and a large X appears on the scope to tell the pilot he is free to break away. Should he fail to get into proper position, the X will denote a missed pass and the rockets will not be fired.

The rockets travel much faster than the aircraft towards the target, so that the intercepter can fly straight on at the same height after firing without colliding with the target. In a head-on attack, of course, actual evasive action would be required and this consists of pulling 50ft upwards under automatic control. However, the exceedingly short time available for the controls to take effect and produce this manœuvre, not to mention the lag which may occur in the aircraft due to high indicated speed of sloppiness at very high altitude, leave little hope of successful evasion in any but the most favourable conditions.

After the attack the radar can be set up for further interception, if any rockets remain; or it can be deflected downwards and used for map-painting and general navigation. A base so distinctively placed relative to a prominent coastal feature as Manston, where F-86Ds are now operating, would give echoes probably good enough to allow a reasonably accurate approach to the glide-path in poor weather or at night with the aid of the aircraft's radar alone.

The Hughes system was produced more or less as a private venture in about 1949, and the U.S.A.F. was by no means convinced that it could be effectively used. But a team of experienced pilots was directed to evaluate the F-86D when it was first fitted with the system. It took some time to settle the system down in conjunction with a comparatively new airframe, but eventually the authorities accepted pilots' opinions and official full-scale trials were held. It was during one of these that a mother ship directing a B-17 drone was shot down by mistake by a F-86D's rockets. (The pilot must be certain of locking his radar on to the right target.) Since then a special banner towed, with a radar reflector, by a B-45 has been developed for tests and has also been used for the annual gunnery meets held by Air Defense Command at regular intervals (*Flight*, October 14th, pp 620-1).

The fuselage of the North American F-86D is crammed with the goods of its trade, as can be seen in this "Flight" picture taken at Manston.



More recently a modification programme was begun to install the latest version of the Hughes system in all the Air Defense Command F-86Ds, F-94Cs and F-89Ds. (Only the F-89D and subsequent marks have the Hughes system.) This includes an autopilot which, when the radar is locked on, does the difficult aiming work for the pilot, who merely sits and monitors its functioning. The same autopilot also provides approach coupling for automatic I.L.S. approaches. It is called Control System Tie-in.

These systems, however, still leave ample margin for the human element which may well succeed in outwitting the electronic brain by evasive manœuvring and all manner of countermeasures. The intercepter's next gambit therefore is embodied in the Convair F-102A system, which includes a new Hughes control. The weapon will be the Hughes GAR-98 Falcon, equipped with its own radar homing head, which will be capable of tracking and striking a manœuvring target when launched at considerable ranges and with considerable disparity in height between intercepter and target. While allowing greater latitude in the firing run it will require much more complex equipment, since the missile's gyros must be spun up and its engine started and radar locked on at the right times before launching.

Later versions of the F-102 will be fully automatic, to the point at which the aircraft will be directly controlled through a pulse-coded radio data link by the G.C.I. station as soon as it gets airborne. When the target comes within range of the intercepter's own radar, the aircraft's equipment will take over and the missile(s) will be launched. Then, once again, the ground station will take over to bring the intercepter back to base. The pilot will have relatively little to do except switching from one control to another, taking off and touching down. Eventually the pilot will be completely eliminated in such intercepters as the Boeing Bomarc.

Radio control of a piloted aircraft's autopilot from a ground station is nothing new, as such a system was used for night attack work in Korea by the U.S. Marines. There is also the story of a Major in the U.S. Signals Corps, with no piloting experience, who rode as supervisor in a specially modified F-86D while it carried out a successful automatic interception. The aircraft took off, flew, fired and landed under full automatic control. The major must have had complete confidence in the equipment, but it all worked without a hitch.

Serviceability of such aircraft as the F-86D was, of course, very poor at first, mainly because the system was not ideally laid out. It had had to be fitted into an existing airframe, with the proverbial shoe-horn. The F-102, on the other hand, has been designed round the fire-control system (or at least its early version) and it is probable that each component will be packaged in such a way that sections can be quickly removed and replaced when a snag is traced. There should also be panels on which standard instruments can be plugged in to trace the faulty package with the minimum delay. There is evidence in photographs so far released that the remainder of the F-102 is similarly divided into easily inspected compartments and components.

CEYLON'S RESOURCES

—to be Surveyed by Air: New Colombo Plan Contract for P.S.C.

A TWO-YEAR aerial survey of Ceylon, to evaluate the country's natural resources, is to be carried out by the Photographic Survey Corporation, Ltd., of Toronto. The Canadian Department of Trade and Commerce recently announced that the company had been awarded this contract under the provisions of the Colombo Plan for the economic development of South and South-east Asia. Cost of the project is estimated at $500,000.

Project manager of the Ceylon air survey is Mr. J. M. Henderson who, for the past 20 months, has supervised all field operations in connection with the P.S.C. air survey of Pakistan, which is now drawing to a close. The Pakistan survey aroused the interest of government officials in Ceylon, after which Canada was requested to make provision for a complete resources inventory of the island, which covers an area of approximately 25,000 sq miles.

Plans for this latest survey were made following a visit to Ceylon by Dr. J. D. Mollard, chief of the Air Photo Analysis and Engineering Geology division of the Canadian Department of Agriculture. A Lockheed Hudson photographic aircraft will be employed, flying at a height of approximately 16,000ft above the ground (to provide the recommended mapping scale of 1/31,680). Mosaics and maps will be prepared from the photographs, and geological and forestry studies undertaken with the aid of special equipment. A selected river basin will be examined from the air and on the ground, and a plan drawn up for its agricultural and irrigational development. Arrangements will also be made to replan the city of Kandy using air photographs, and an air survey operations centre will be established at Colombo on a permanent basis. At this centre, which will be equipped with full laboratory facilities, Ceylonese technicians will be trained in modern air survey methods.

The P.S.C. Hudson destined for the Ceylon survey, pictured at Oshawa. Object of the aircrew's attention is an RC-5 survey camera.

The purpose of the survey, according to Mr. Henderson, is to locate sources of potential wealth in the island and lead to their development along planned economic lines. A P.S.C. team including specialists in aerial survey, photography, geology, forestry, soils engineering and other allied fields will accompany Mr. Henderson to begin initial work on the survey in the immediate future. In charge of these specialist functions will be H. S. Scott, chief geologist (and director of the P.S.C. Resources Survey Division); V. G. Merritt, chief forester; R. C. Hodges, field survey chief; and D. R. Lueder, chief civil engineer.

Speaking on the occasion of the inauguration of the new project in Toronto last month, Mr. N. Cavell, administrator of the Colombo Plan in Canada, said that Canada had carried through, or was in process of carrying through, 45 capital projects in various South-east Asian countries. In the Ceylon operation, Col. E. A. Rajasingham (the Superintendent of Surveys of Ceylon) would co-operate in planning the various details.

REAL SAUCERS

AT the end of last month the Secretary of the U.S. Air Force, Mr. Donald Quarles, spoke at some length on the joint American-Canadian contract for the development of an aircraft which would undoubtedly be more like the popular conception of a flying saucer than any other aircraft yet projected.

The original concept was formulated several years ago by Avro Aircraft, Ltd., of Toronto, under the code name of "Project Y" and, under the direction of the Rt. Hon. C. D. Howe, Canadian Minister for Defense Production, Avros completed a design study at a cost to the Canadian Government of $397,000. On the other hand, the cost of building a prototype, estimated at £100m, was considered beyond the capability of the Canadian industry, even with the backing of the remainder of the Hawker Siddeley Group. The project, however, appeared to be of such technical interest and future potential that it was taken over by the U.S.A.F. Air Research and Development Command and is now largely American property.

In its original form the Avro project would have two disc-like surfaces separated from each other by a fixed gap inboard of their periphery. Gas would issue from an annular orifice between the two discs, inboard of the actual perimeter of the saucer, and would then behave according to the Coanda effect and leave the saucer with a deflection appropriate to the flight regime concerned. At one particular value of the gap, the flow would issue horizontally to produce level transitional flight; at another gap opening the exhaust could be deflected at an angle upwards or downwards to introduce a vertical thrust component while, for vertical take-off, the top portion of the gap would be closed and the opening adjusted to deflect the exhaust vertically downwards. For transitional flight, the gap would be adjusted to a horizontal exit flow and would then be closed around the front half of the perimeter. A substantial proportion of the total flow could be diverted through hollow control elevons, although it is by no means certain that any such surfaces are being considered on the Avro project.

No details of the powerplant have yet been published but it is known that, before the evolution of the true saucer, Avro were considering a D-shaped aircraft resembling a saucer with a straight trailing-edge, for which an elementary engine scheme was developed in project form. A form of turbojet would have been used, the compressor being in the form of a large disc with peripheral blades providing for radial compression of the intake air. The inboard end of the disc would have been supported by conventional bearings whereas the outboard section was to be carried by an air-bearing fed with compressed air, which would also act as a cooling flow between the rotor and combustion chambers positioned on either side of it outboard of the compressor portion. Turbine blading would have been located at the extreme periphery of the disc. Gases passing through the wheel would be guided rearward through cascades in front of openings along the sides of the D-shaped body. For take-off the aircraft would have been tilted up to about 70 deg from the horizontal, resting on its straight trailing-edge. Take-off would then have been effected without ground run.

A wooden mock-up of this earlier project was actually completed some years ago. This mock-up measured approximately 25ft long and 21ft across and would have accommodated a prone pilot.

CHELSEA COLLEGE PRIZEGIVING

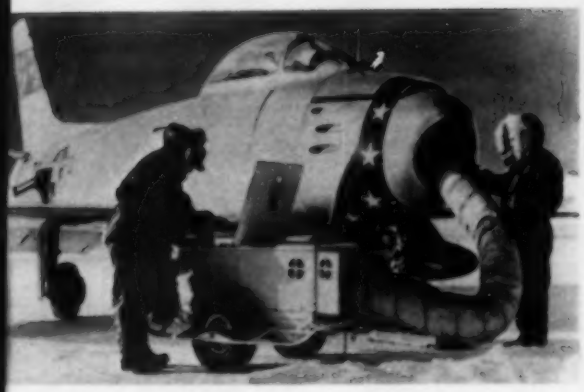
THE annual presentation of diplomas to students of the College of Aeronautical and Automobile Engineering took place at Crosby Hall, Chelsea, on Thursday of last week. Following an address of welcome by Lord Sempill, a review of the College's work was given by the Principal, Mr. G. D. Duguid, M.A. There were at present 385 students, he reported, of whom over 250 had come from overseas. During the past year, 11 had passed examinations leading to Associate Fellowship of the Royal Aeronautical Society. Referring to internal examinations, the Principal said that, of the 118 diplomas awarded, 62 were in automobile engineering, 25 in aeronautical engineering and 31 in agricultural engineering.

The presentation of trophies and diplomas was made by Mr. Hugh Molson, M.P., Joint Parliamentary Secretary to the Ministry of Transport and Civil Aviation, following an address dealing with road transport topics. A confident and amusing vote of thanks to Mr. Molson was expressed by J. A. van Beugen Bik, a senior student. The following awards (excluding those in automobile and agricultural engineering) were made:—

Mollison Challenge Trophy, for general efficiency in aeronautical engineering, J. L. Rudkin (presented by Mr. Jim Mollison);

Olley Challenge Trophy, for practical ability in aeronautical engineering, B. J. Turpin (presented by Capt. G. P. Olley);

Diplomas (Aeronautical engineering): M. M. Ali Baig, N. T. Hazelden, A. E. Moniz, R. W. Nesult, R. A. Nicol, A. S. Quraishi, A. Rusin, J. L. Rudkin and G. Tzanoudakis.



THE TRAIL OF '55

PENETRATION of the Far North by aircraft, both military and civil, has become almost commonplace within the past few years. Seldom are they engaged on exploration; far more often on routine transport duties, though sometimes on rescue. The enterprise of Canada's "bush flyers" is a byword; and for several months past a major airlift has been conducted in the Canadian Northlands in connection with the building of the DEWline radar chain. Other large-scale operations, occurring periodically, are mass ferry flights, and on this page are scenes during the recent move of the U.S.A.F.'s 21st Fighter Wing from California to France *via* Labrador, Greenland, Iceland and Scotland. The right-hand picture shows F-86 Sabres, equipped with drop tanks, taxying over frozen snow at Goose Bay, Labrador; and, below, the aircraft of the wing are seen in Southern Greenland, with C-54s and SA-16A rescue amphibians in attendance. The curious-looking operation shown in the small picture above, taken in Greenland, is the preparatory warming-up of an F-86 by two sergeants with the aid of a transportable heater.

A GERMAN ULTRA-LIGHT

Dittmar Motor-Möve Goes Into Production

NOW that they are once more authorized to use powered aircraft, German club pilots are faced with the problem of initial cost. One solution offered to them lies in the Motor-Möve, which has been developed over the last two years by Heini Dittmar, former Messerschmitt test pilot and world gliding champion of 1937. It is claimed that, excepting one or two foreign ultra-lights, the aircraft will be cheaper than anything available in Germany. All imported aircraft are, of course, subject to duty.

For more than two years Dittmar has been working on his design. It first appeared as a glider, but a powered version was completed outside Germany and more than 120 trouble-free flights were made. A second machine has now been finished in Germany as a prototype for a production line which is now being laid down. A number of German pilots, it is reported, have flown the Motor-Möve and have pronounced it to be an excellent aircraft for clubs and private pilots. Its good flying and handling characteristics, they say, also suit it for young pilots of limited experience.

The machine is a side-by-side two-seater and, in production, will have dual controls. Good forward and lateral visibility are afforded by large side windows and an ample curved windscreen. The tricycle (with steerable nosewheel) undercarriage is "fully sprung," making it suitable for landings on unprepared fields. The production version will have a Continental 65 h.p. engine and a 17 gal fuel tank, giving an endurance of 4.5 hr and a range of about 400 miles. This performance is claimed to be suitable for touring as well as club flying. When flown solo, extra tanks can be added to bring the endurance, with the 65 h.p. engine, up to 13 hr.

As might be expected in view of its ancestry, the machine can be quickly and easily dismantled. Removal of two bolts releases the tail surfaces. The wings, rudder and tailplane can then be fastened to the top of the fuselage and a forked tow-bar attached to the undercarriage. Thus the Motor-Möve can be towed behind a car and all ordinary roads can be negotiated.

When fitted with the 65 h.p. engine, the aircraft can also tow gliders, and it is stated that a Grünau Baby can be towed to 1,600ft in five minutes. In addition, a variety of other tasks, such as crop-protection, fire-watching, mountain rescue, and police duties are also claimed to be within its scope.

Production began last month in a new factory at Kempten/Allgäu in Bavaria. Workshops, assembly hall, and an airfield have been made available by the town council of Kempten, but the venture is completely privately financed. From Kempten the first aircraft will be delivered in a few weeks and demand is said to be high, because, at DM15,000 (about £1,080), the Motor-Möve is Germany's cheapest, if not its first, post-war production aircraft. Initially, the machines will be delivered only with factory-new engines, usually the Continental 65 h.p. or 90 h.p., but it is foreseen that some customers will provide their own engines, e.g., second-hand Continentals. As soon as an equivalent German engine becomes available it will be adopted in favour of the Continental.

The Motor-Möve's type number is HD 153 and it is a cantilever, high wing, cabin monoplane with cantilever tail surfaces, all built of wood. The HD 53 Segel-Möve, a side-by-side two-seat training glider, is also offered. The HD 153's wing is built around a single continuous main spar with a plywood nose-section forming a torsion box. Spoilers are provided in the upper surface. The tailplane is a plywood torsion box with fabric-covered elevator, provided with spring-tension trimming; the balanced rudder—there is no fin—is of similar construction. The whole fuselage is plywood covered, its top surface aft of the wing being removable. There is a single access door on the left. The faired undercarriage is supplemented by a tail-bumper. Space for baggage is provided behind the seats, the cushions of which are removable. Standard instrumentation consists of an altimeter, A.S.I., variometer, turn indicator, compass, clock and r.p.m., oil temperature and oil pressure gauges.

Dittmar started flying in 1929 on the Wasserkuppe and built his first glider, the Condor I, in 1931. He won the Rhonsegelflug Championships in 1932-33 and gained considerable experience of Alpine gliding in 1936 in his own Condor. From 1939 to the end of the war he was test pilot for tailless rocket aircraft with Messerschmitt, and in 1941 he won the Lilienthal Prize for exceeding 1,000 km/hr (622 m.p.h.) in the Me 163. In 1951 he took up gliding again and built the Condor 4 glider, before starting on the Möve design.

Heini Dittmar's Motor-Möve, claimed to be the first aircraft to go into production in Germany since the war, is powered by a 65-h.p. Continental engine and seats two side by side.

DITTMAR MOTOR-MÖVE

(Continental A65-8F, or C90-8F or 12F versions with electric starter)

Span		38.4ft
Length		20.8ft
Height		5.1ft
Fuselage width		3.3ft
Wing area		197 sq ft
Wing loading		6.6 lb/sq ft
	65 h.p.	90 h.p.
Max. speed	102 m.p.h.	124 m.p.h.
Cruising speed	90 m.p.h.	105 m.p.h.
Landing speed	37 m.p.h.	37 m.p.h.
Take-off run		448ft
Braked landing run		256ft
Time to climb to 3,200ft		7 min
Max. a.u.w.		1,540 lb
Empty weight		816 lb
Max. load		726 lb
Fuel capacity		normal 17 gal
		max. 45.5 gal
Airscrew diameter		5ft 9in

The Motor-Möve can be dismantled and towed on its own undercarriage after attachment of the special tow-bar seen in this photograph.

MAINTENANCE BASE AHOY

WORK on a "mobile beaching vehicle" is nearing completion, and tests by Martin, the designers, and the U.S. Navy are expected to start very shortly. The apparatus, which could be moored unattended, is intended to provide additional mobility for new seaplanes such as the U.S. Navy's XP6M-1 SeaMaster, currently being flight-tested at Baltimore. A more ambitious floating dock, to be tested early next year, is designed to be partially submerged so that the seaplane can taxi directly on to it, the dock being afterwards raised by inflatable air bags. Full facilities including hydraulic, electrical and pneumatic power and mechanical cranes will be available for servicing and maintenance.

FASTEST FARTHEST HIGHEST
Crew Comfort
VICTOR
Pilots sit side-by-side in its large comfortable cabin. They have a good view through windscreen panels which preserve the fine aerodynamic lines of this crescent-wing bomber's nose.
HANDLEY PAGE RADLETT LONDON READING
FASTEST FARTHEST HIGHEST

Problems of flight

FORMATION FLYING

Aircraft fly in close formation so that they can be closely controlled for attack, defence, deployment. A flight in formation can change direction or altitude or speed with the precision of a company of Foot Guards on the square. The technique of formation flying—so spectacular to watch, so essential for air tactics—is made possible by communications. There must be constant pilot-to-pilot contact. The commander must be able to give anticipatory orders to all his pilots, or any one. Who could conceive of tactical bombing (for example) without this tight and continual control?

But what of Nature's formation flying? What of a skein of geese, that astonishing wedge of fast-flying birds that plot a course by some immemorial skill to their feeding-grounds in the South? What device of command directs them into their formation, and keeps them in it, over continents and oceans? What of a flock of plover, a hundred strong, turning in the air so exactly on the second that you see, suddenly, a hundred pale undersides where you saw a hundred dark backs? What system of communications tells every bird in that flock the exact moment to turn, the exact direction to fly?

We know why these birds fly in formation. Their reasons are the same as ours. They find safety and effectiveness in numbers, and they must keep these numbers together. But we do not know how they do it. Possibly we never shall. We can only say that some instinct, as old as the species, impels the geese to join into a particular formation for their journey; we can only say that some telepathy, more mysterious than wireless and far more efficient, gives every plover the same order at the same moment.

The deployment of aircraft in formation makes possible the tactics of modern air warfare. But formation flying is more ancient than man himself. It is another of Nature's solutions to the problems of her flying creatures that we, a million years later, have managed to imitate.

Whether flying in formation or alone, pilots who land at airfields all over Britain have come to value the excellent and helpful service of the Shell and BP Aviation Service.

SHELL and BP AVIATION SERVICE

Shell-Mex and B.P. Ltd., Shell-Mex House, Strand, London, W.C.2.

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CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Helicopter Rotor Practice

YOUR correspondent Mr. Robertson [October 28th] has been a rigid-rotor enthusiast for some time, and indeed he is something of a pioneer in this country. Although I agree that where it is structurally possible, a rigid rotor is preferable to an articulated one, I cannot agree that it is structurally a practical proposition for any but the smallest helicopters. In any case, the main point of my article was that an articulated rotor is poor, a rigid one is better, but one with a "stiff hinge" is better still, in every respect. This point is elaborated in my paper in the November issue of *Aircraft Engineering*, where it is shown that a hinge of optimum stiffness gives a stable helicopter, removes speed limitations, reduces vibration and gust deflections, increases control response and permits indiscriminate loading.

This last point alone would yield a 100 lb payload increase on one production helicopter at present in service. Moreover, these advantages could be achieved in part (the limitation being one of blade bending strength) on any existing helicopter by means of a simple modification to the flapping hinge, whereas it is certainly not possible to apply the "rigid" rotor principle in this way.

I must frankly admit that when rumour reported some years ago that Mr. Robertson was associated with a rigid-rotor project, I then thought the the accumulation of more experience would lead his team to change their views. In fact, I have changed mine, and whereas he advocates a "rigid" rotor which is flexible, I am advocating a rigid blade which has a flexibility located at the hub! The only point of disagreement is the degree of flexibility, and if Mr. Robertson reads the paper referred to above he will see that I have tried to show that optimum "hinge stiffness" is quite low. It is structurally easier and more reliable to use a hinge and torque bar than to rely on blade bending stiffness, but the two methods are more or less equivalent.

Since nearly all the helicopter research work carried out in this country is done by the helicopter companies it is a great pity that the results of some investigations are never published. Is it possible for Mr. Robertson to say anything about his "rigid" rotor work, and whether any success was met in practical applications? It would certainly be of considerable interest to other helicopter engineers.

Clevedon, Somerset. P. R. PAYNE.

An Owner on the Tri-pacer

MY wife and I were interested to read your report "Handling the Piper P.A. 22 Tri-Pacer," in the issue of *Flight* dated August 12th. It should, however, be made clear that the model tested was the latest 150 h.p. O-32 model, the first one to be delivered to Southern Africa.

A mandatory modification has come out involving the replacement of the carburettor main jet, which now gives us 2 hr 45 min flying at 2,350-2,375 r.p.m. at a ground speed of 120 m.p.h. on 15 Imp. gal of petrol. This further enhances the use of the Piper Pacer as an economical executive transport.

Since 1933 this is the fourth aircraft I have owned for my personal transportation, having flown some 2,500 hr moving my wife and myself about, and I find it is the first aeroplane to suit our requirements in every respect.

The tricycle undercarriage removes from the pilot the need for any judgment in landing the aircraft under any conditions of wind direction. Airport controllers route the Tri-Pacer on main runways used by airliners, while all other light aircraft are directed on to into-wind runways. The excellent take-off performance and ridiculous ease-of-handling characteristics make this the ideal "old man's aeroplane."

I have rung up 320 hr on the air log since January 10th this year and have not been put to any maintenance expense at all. I write as an enthusiastic owner, with no sales connection with the Piper organization.

Umtali, S. Rhodesia H. H. C. PERREM.

A Water-launched Glider of 1919

THE article on aero-towing of sailplanes, in *Flight* of November 4th, recalls an unusual episode in aviation history. Towards the end of the First World War, A. H. G. Fokker, then working in Schwerin, Germany, became interested in gliding. In accordance with his suggestions, an engineless Fokker D.VIII parasol fighter was converted for aero-towing. Disagreeing with the idea of aero-towing a rather heavy glider, the designer, Herr Reinhold Platz, put into effect an idea of his own while Fokker was absent in Holland immediately after the armistice. The result is shown in the rare works photograph on this page—a flying-boat sailplane for towing-off from water.

The Fokker flying - boat glider referred to below by Mr. A. R. Weyl.

Like all aircraft by the same designer, the sailplane was of most simple construction, consisting of a welded steel-tube fuselage with a plywood-skinned box-type float attached to it, and a cantilever thick wing of about 110 sq ft area having two wooden box spars and fabric covering. The small black fitting seen at the nose of the fuselage (it was attached to the upper longerons) was a coupling for the towing cable. The release operating this coupling from the cockpit was typically primitive, consisting of a modified pair of pliers and a turnbuckle.

In the light of today's knowledge the aerodynamic efficiency would seem to be impaired by the cockpit arrangement and the cut-out in the wing leading-edge, which must have interfered with the lifting airflow.

Flying experiments with this sailplane were made on the Ymuiden Canal near Amsterdam during 1919. Flown by Herr Parge, then Fokker test pilot, the aircraft handled well. A. H. G. Fokker was in the motor boat which acted as tug. The short launching cable restricted the altitude to only 150ft, so that any attempt at soaring after release was out of the question.

Dunstable, Beds. A. R. WEYL.

Albatross Remembered

WITH reference to the letter from Mr. Mawby (October 14th), I was at Reykjavik at the time when the Albatross G-AEVV *Faraday* came to grief, and your original correspondent Mr. Bowyer might like to know the details.

While taxying in after a trip from England its wing hit the tail of a Fairey Battle. The Battle wasn't even scratched, but *Faraday* lost about eight feet off its wing-tip. The wooden spars of an Albatross were in one piece from wing-tip to wing-tip, so the wing was much too bulky to ship to England for repair. I know it grieved me at the time to see such a beautiful aeroplane—even with today's fashions it would be beautiful—dumped into a corner of the aerodrome and forgotten.

Largs, Ayrshire. E. A. STARLING.
Flight Manager, Renfrew Flight, B.E.A.

FORTHCOMING EVENTS

Nov. 11. Helicopter Association: "Design of Helicopter Operating Sites," by H. T. Hough, M.I.C.E., M.I.Mun.E., M.T.P.I.
Nov. 12. British Interplanetary Society: Overseas Lecture: "Space Travel and Future Research into the Structure of the Universe," by Dr. J. M. K. Kooy.
Nov. 12. British Interplanetary Society: Birmingham Branch: "Second Steps in Astronautics," by L. R. Shepherd, Ph.D., B.Sc.
Nov. 15. R.Ae.S.: Section Lecture: "The Planning of Experiments," by Sir Ronald A. Fisher, Sc.D., F.R.S.
Nov. 17. R.Ae.S.: All-day Section Lecture: Design Philosophy (Speakers: Dr. P. B. Walker, H. Giddings, C. F. Joy, J. K. Williams).
Nov. 17. R.Ae.S.: Graduates and Students Section: "The Supersonic Fighter," by J. W. Fozard.
Nov. 18. Elstree Flying Club: Informal Reunion of Pre-war Brooklands Flying Club Members.
Nov. 22. R.Ae.S.: Section Lecture: "Aviation Journalism," by Charles Gardner, O.B.E., A.R.Ae.S.
Nov. 24. R.Ae.C.: Film Show (Members and Associates only).
Nov. 29. Society of Instrument Technology: "Electronic Computing Methods," by A. St. Johnston, B.Sc., A.M.I.E.E., A.C.G.I.
Nov. 29. R.Ae.S.: Section Lecture: "The Noise of Jet Engines," by F. B. Greatrex, B.A., A.F.R.Ae.S.
Dec. 1. R.Ae.S.: Main Lecture: "Free Flight Techniques for High Speed Aerodynamic Research," by P. A. Hufton, M.Sc. (at Boscombe Down)

R.Ae.S. Branch Fixtures (to November 28th):—

Nov. 14, *Bristol*, Junior Members' Papers Competition; *Halton*, "Airframe Fatigue," by W. Tye Nov. 16, *Manchester*, "Inter-planetary Flight," by E. Burgess; *Coventry*, Lecture by H. F. Bainbow; *Reading and District*, "Man and the Aircraft Workspace," by W/C. H. F. Ruffell Smith.
Nov. 21, *Halton*, "Photographing Aircraft," by Charles E. Brown. Nov. 22, *Belfast*, "The Britannia," by Dr. A. E. Russell. Nov. 24, *Isle of Wight*, "Ejection from High Speed Aircraft," by J. Martin.
Nov. 28, *Halton*, Film. Dec. 2, *Chester*, Annual Dance.

THE INDUSTRY

Blackburn Board Appointments

FROM Blackburn and General Aircraft, Ltd., comes the announcement that Mr. Eric Turner, A.C.A., has been appointed chairman in succession to the late Mr. Robert Blackburn. Mr. Turner will remain managing director, an appointment which he has held since 1951.

Mr. W. A. Hargreaves, M.B.E., A.M.I.C.E., F.R.Ae.S., has retired from full-time duties with the company but remains on the Board; and Mr. T. Bancroft, M.I.P.E., A.F.R.Ae.S., general works manager for many years, has joined the Board as production director in place of Mr. Hargreaves.

Mr. Turner, after a distinguished war-time career in the Army, joined Blackburn Aircraft as chief accountant in 1946 and was appointed Secretary two years later. He joined the Board in 1950 and a year later was appointed managing director.

Mr. Bancroft joined the company after the First World War, in which he served as a flight sergeant in the R.F.C. and later the R.A.F. He was chief engineer of the North Sea Aerial and General Transport Co. and later took up a similar appointment with the Blackburn flying training schools at Hanworth and Brough. During the Second World War he was works manager of the Blackburn factory at Sherburn and returned to Brough in 1944 as general works manager.

Mr. Eric Turner.

Mr. T. Bancroft.

Mr. Hargreaves, after an engineering apprenticeship, held appointments with Supermarine and Vospers before joining Blackburn as assistant designer. He was later appointed assistant general works manager and went to the Dumbarton factory, where he was responsible for the production of 250 Sunderlands during the war. In 1951 he returned to Brough as works director. His retirement from the Board of Blackburn (Dumbarton), Ltd., for reasons of health, was announced at the beginning of this year.

Battery Manufacturers' Progress

SPEAKING at a dinner held in London recently to celebrate the 90th anniversary of Oldham and Sons, Ltd., Mr. John Oldham, O.B.E. (chairman and joint managing director) said that though at the end of the war the company's overseas activities had to be started from scratch, today some 50 per cent of Oldham business was represented by direct exports and overseas manufacture.

Paying a tribute to the company's "backroom boys," Mr. Oldham spoke of the success of the Fibrak synthetic separator first introduced a little over three years ago; it was now manufactured on three continents and was one of the most widely used separators in the world. The latest Oldham technical development was the "Power Seal," which would be employed to an increasing extent and for a variety of battery applications on land, sea and in the air.

Beacons For Antarctica

AIRCRAFT accompanying two forthcoming Antarctic expeditions will be guided by Redifon radio beacons. The Hunting Aerosurveys group, now on its way to Grahamland, will operate a Redifon G.40, and the Commonwealth trans-Antarctic expedition will use two Redifon T.1918s.

The standard G.40 supplied to the Hunting party has an output of 500-750 W and will operate on C.W., M.C.W. and telephony. It is to be installed on Deception Island and will assist the two Canso photographic aircraft undertaking the survey flights. Apart from providing navigation signals, the G.40 will also be used to provide the crews with meteorological reports.

Mr. A. W. Isherwood, Director of Contracts, Ministry of Supply, recently visited the Avro factories at Woodford and Chadderton. He is seen (centre) in the computer room at Chadderton, discussing a point with an operator and Mr. J. A. R. Kay, sales director.

The main task of the Commonwealth trans-Antarctic Expedition is the setting-up of bases for a complete crossing of the South Pole by an expedition during 1957-8. Two Mk. 7 Austers will provide aerial reconnaissance, and the Redifon T.1918s will be used to home them to their bases.

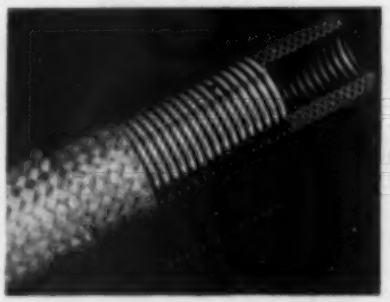
Of exceptionally robust construction, the 300-watt T.1918 was developed for and is being supplied to the R.A.F. To simplify transportation it can be divided into three units which may be stacked vertically or horizontally, permitting its use as either a fixed or mobile station. The T.1918 was first shown in public at this year's S.B.A.C. Exhibition.

Anglo-American Hose

IT is announced that a new Anglo-American company, Power Auxiliaries, Ltd., has been formed for the production of seamless flexible metal hose for aircraft and fighting vehicles. Known as "Plessiflex," it is designed to withstand, over long periods, the high temperature and pressures associated with modern powerplants. The life of the hose couplings, also, is stated to be considerably in excess of present periods.

Power Auxiliaries, Ltd., is a joint company formed by the Plessey Co., Ltd., and the DK Mfg. Co. of Chicago. The hose is produced to material specifications of the DK Co., and to proving specifications of the Plessey Co., for the whole assembly.

The interior construction of "Plessiflex" is shown in the accompanying illustration. Materials generally employed are stainless steel, brass and bronze, but experiments are about to begin with titanium.

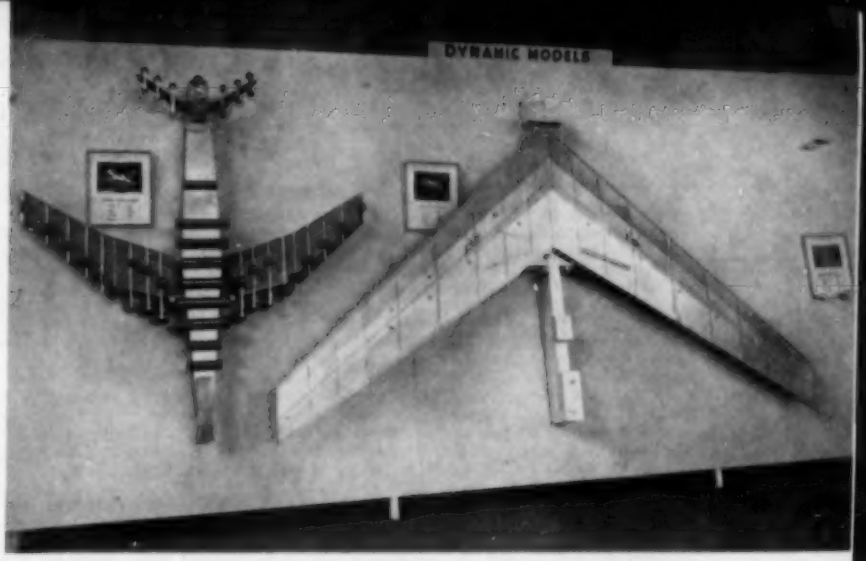


Cross-section of "Plessiflex" hose—a continuous circular metal coil formed in seamless metal tubing and covered by double braiding.

The hose assemblies have been subjected to rigorous tests by one of a well known British aero engine manufacturer and, as a result, a limited size-range has been approved for production release. Tests continue on the remaining sizes and it is hoped that a complete range of "Plessiflex" for aero engine installations will shortly be available.

The Industry

VIBRATION TESTING



Typical dynamic models; of the Swift (left), in which loading conditions can be altered by changing the appropriate weights, and of a Cranfield design project (right), incorporating riveted construction for structural-damping experiments.

ONE of the problems which has arisen with the trend towards thin wings for high-speed aircraft, is that of obtaining the desired wing stiffness without an unreasonable weight penalty. The low density of aluminium alloys is accompanied by low elastic moduli and hence, in order to obtain the same stiffness as from heavier metals, dimensions of light-alloy sections have to be increased well beyond those required from strength considerations alone.

Sandwich construction is one alternative to an increase in skin thickness. With increasing complexity of design, however, a corresponding difficulty is found in performing all the mathematical calculations (concerning load capacity, stiffness, aerodynamic behaviour and other properties) necessary if all likely conditions are to be considered.

Approximation provides a useful shortcut and, of course, much work is done by this method. This alone is not sufficient, however, and it has become standard practice to solve many such problems by ground resonance tests. These are compulsory on all military aircraft, and are carried out as a matter of routine on most civil aircraft before they commence service.

Such ground tests are carried out not only on finished aircraft but also on experimental wings, tails and fuselage-sections. It is more usual in the design stages, however, to make scale models, which can very conveniently be used to obtain quantitative results. These models vary greatly in complexity and cost; some may be completed in about six man-weeks and cost less than £100, while others may take up to several man-years with a cost running into several thousand pounds. Generally speaking, however, models costing a few hundred pounds will give results which are close enough for all practical purposes.

For ground resonance testing the important features of the model are mass, stiffness and length. If these features are correctly proportioned, a valid frequency scale is automatically established. For the normal sizes of model, this frequency scale is about four times higher than that on the full-scale aircraft under similar conditions. When the design of an aircraft has been finalized with the use of models, it is subsequently possible to test the actual aircraft itself by similar means.

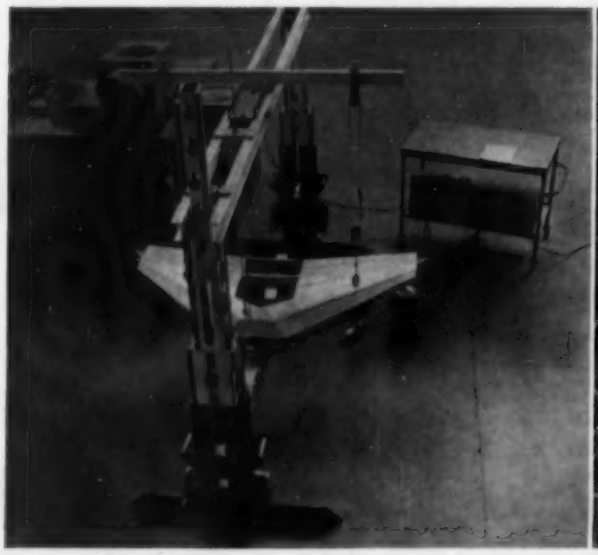
Because of the importance of this design technique, the Department of Aircraft Design of the College of Aeronautics at Cranfield has done much to instruct future design engineers in the methods used. As with all work at the College, the experiments have been so designed that useful new information is obtained as the result of the students' research.

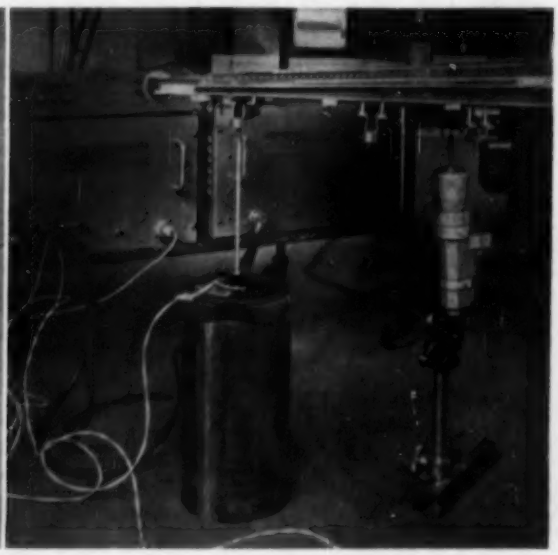
The photographs show a typical rig and models used in vibration and structural-damping tests. These models are suspended from the framework by means of rubber cords having a natural frequency of vibration well below that of the applied vibration (in the case of tests on full-scale aircraft the supports take the form of air bags or deflated tyres, of low natural frequency).

Vibration is applied to the models by means of Goodmans Type 390A vibrators, together with the necessary oscillators and amplifiers (made for this purpose by Goodmans Industries, Ltd., Axiom Works, Wembley). In the photograph below, left, two of these vibrators are shown applied to the ends of the wings of a delta-wing model. The model is suspended from its bungee cords at the points at which the main landing wheels could be placed in the actual aircraft, and the third support is placed where the nosewheel would normally come.

The vibrators work on the moving-coil principle, an ideal method where quantitative results are required. The oscillator and amplifier units which feed the equipment can be set to

In the general view of the rig (left), the model is suspended from an adjustable frame, the vibrators are under the wings, oscillator and amplifier units on the movable bench, and osilloscope on the left. Right, attachment of vibrator to wingtip, and stand-mounted induction-type pick-up.





The Industry

supply the vibrators with a known current at a known frequency. The vibrators then oscillate the structure under test at a force which is determined by the current supplied, and at the supply-current frequency. The frequency and magnitude of the vibrating force are therefore controlled and known within close limits.

A simple bridge circuit would make it possible to keep a continuous record of the motional impedence offered to the current by the oscillator. This means that the actual movement (both amplitude and acceleration) of the test piece can be determined by simple electrical measurements on the vibrator.

In the case shown, amplitudes must be measured at many points on the model structure. This is done by the use of induction-type pick-ups which are held in simple clamps, as shown in the detail photograph, so that they are in contact with the surface of the model. The signal picked up is then amplified and displayed on a cathode ray oscilloscope.

By feeding the vibrators from a wobbulator—a source of varying frequency—it is possible to vary the frequency of vibration automatically over a range from 20 to 200 c/s in about 2 min. A photographic record of the cathode-ray screen during this period will provide a complete frequency spectrum for the design represented by the model, at the point at which the pick-up is applied. An advantage of the rig shown is that it is possible to run the two exciters either in phase, or out of phase, with each other.

Vibration tests on models are also being used to investigate structural damping. For vibration calculations it is necessary to know the degree of damping experienced by the aircraft in a given mode of vibration, because this factor influences the response of the structure to a rapidly applied force, such as a gust, and the speed at which flutter begins. Part of this damping is due to the air and the remainder to the structure. Each riveted joint in an aircraft contributes to the total structural damping, and it would be of great value to be able to predict the magnitude of this effect for a given design. Some time ago, tests at the College were started on a beam having simple riveted joints. The work then moved systematically to more complicated joints and riveted structures, and has now been extended to complete models and aircraft sections. Correlation of these ground tests with flight resonance tests is carried out with the use of the College's D.H. Dove "flying laboratory."

Other problems to which similar vibration-testing equipment is being applied include the calibration of accelerometers and the testing of power-operated controls for aircraft, to locate resonance and to eliminate "judder."

THE INDUSTRY IN BRIEF

GENERAL sales manager of Field Aviation Co., Ltd., of Oshawa, Ontario, Mr. Gordon Duguid, has been appointed to the Board of directors of the company. Well known in the United Kingdom aviation industry, Mr. Duguid served with Bomber Command and then joined the Ministry of Civil Aviation before emigrating to Canada in 1951.

* * *

The sales office of Exactor, Ltd., has been transferred to the company's works at Church Way, Edgware, Middlesex, and all future correspondence should be sent to that address.

* * *

Chamberlain Industries, Ltd., of Staffa Works, Staffa Road, London, E.10, have recently supplied twelve of their standard "Staffa 3" petrol-driven mobile cranes to Egypt. The cranes were purchased for the Egyptian Air Force, and delivery was effected within eight weeks of receipt of the order.

* * *

Among the varied duties of a David Brown 30 ITD tractor, to be used by Hunting Aerosurveys, Ltd., on their expedition to Grahamland will be those of hauling the two Canso amphibians out of the sea and of clearing a parking area for them. The likelihood of violent storms will frequently make it necessary to remove the aircraft from the water.

* * *

A new edition of a coloured wall map (30in by 40 in) showing world oil production figures for 1954 has been produced by the Petroleum Information Bureau. It also illustrates intake capacity by refineries processing crude oil. Copies are obtainable at 2s, post free, from the Bureau's offices, 29 New Bond Street, London, W.1.

* * *

The first of a new series of six booklets on the argon-arc welding of light alloys, published by the British Welding Research Association, has recently appeared. Entitled *The Principles of Argon-arc Welding Aluminium*, this illustrated publication serves as an introduction to the process. The remaining five booklets, *Electrical Characteristics and Equipment, Metallurgical Considerations, Design Applications and Costs, Techniques and Procedures*, and *Inspection and Testing*, will each be published separately to ensure that the information given is up to date. The first can now be obtained from the B.W.R.A., Publications Dept., 29 Park Crescent, London, W.1, price 2s 6d.

* * *

Photographic Survey Corporation, of Toronto, announces the appointment of Mr. J. H. (Bert) Cornell, commercial manager, to the Board of directors. Mr. Cornell joined the R.C.A.F. photographic section in 1940, and in 1942 trained as a navigator. He was commissioned and posted to S.E. Asia Command, taking part in night-bombing, supply dropping and other duties. He joined P.S.C.'s aircraft operating company, Kenting Aviation, as a navigator in 1946, transferring to the sales division, and later becoming commercial manager.

* * *

The council of the British Institution of Radio Engineers announce that the Brabazon Premium has been awarded to J. W. Jenkins, J. H. Evans, G. A. G. Wallace and D. Chambers for their paper on *A High-Definition General-Purpose Radar*. The paper was published in the Institution's journal for January 1954.

* * *

Until recently general sales manager of the Furzehill Group, Mr. H. L. Ranson, M.S.M.A., A.M.Brit.I.R.E., has been appointed general sales manager of Besson and Robinson, Ltd., electrical relay, wave-guide and control specialists of Harlow, Essex.

* * *

The Walterisation Co., Ltd., Purley Way, Croydon, issue a new leaflet describing the Walterisation E process. In aircraft applications the rapidly formed phosphate coating conferred by this process is stated to have proved eminently suitable for the bonding of the silicone-base resin paints.

* * *

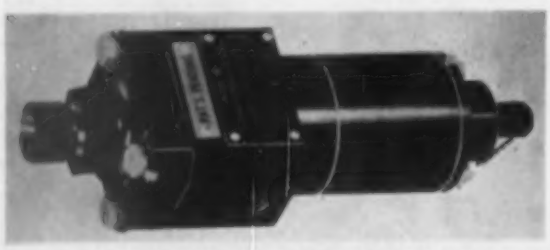
An attractively printed and abundantly illustrated brochure telling the story (not the history, for it is concerned with the present) of the Exide Works of Chloride Batteries, Ltd., has been issued by the company. It describes the organization of the firm at home and overseas, and how their batteries are made, delivered and serviced. This 55-page publication is entitled *Batteries are our Business*.

* * *

At a recent party at Grosvenor House, 25 people—drawn from all grades of employees of Bakelite, Ltd., from hourly-paid to top management—gathered to pay tribute to Mr. H. V. Potter, their managing director, on his retirement. Mr. G. W. Hodda, who is succeeding to the post, said that Mr. Potter had been with the company and its predecessors for over 40 years, and he had been making synthetic resins long before the generic term "plastics" was adopted.

* * *

Mr. B. J. Hurren, who was an official representative at the Geneva Conference on the Peaceful Uses of Atomic Energy, has written a book designed as a layman's guide and primer to the whole subject of atomic power in its civil applications. The book is to be published by Ian Allan early in the New Year. B. J. Hurren wrote *Fellowship of the Air* (published by Iliffe) the official history of the Royal Aero Club. He was for ten years sales development manager for Fairey Aviation before joining the public-relations firm of A. E. L. Mash and Associates.



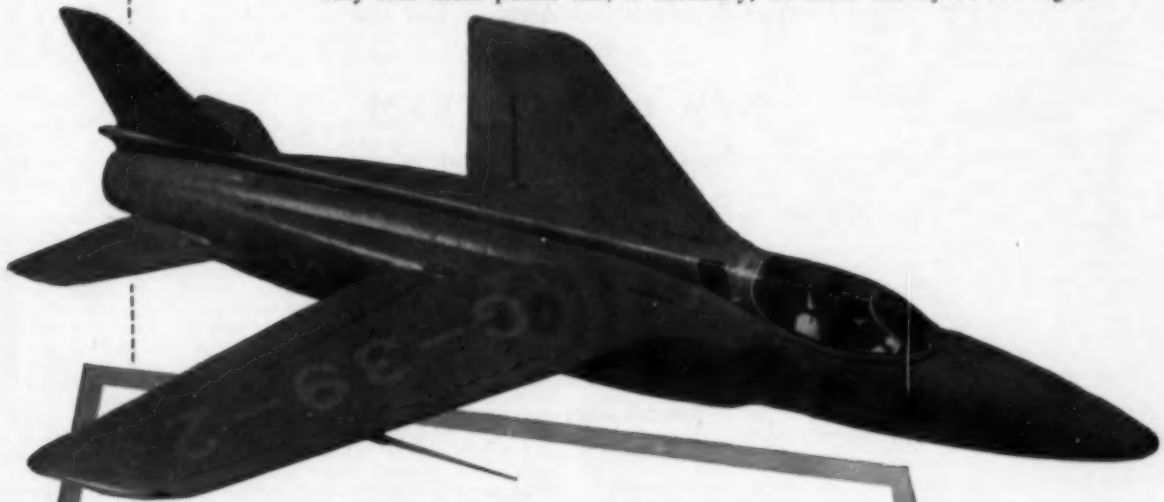
Known as the PS.60 range, a new series of aircraft hot-air reducing valves has been added to the Hymatic range, extending the PS.48 series. They can stabilize inlet pressures of up to 160 lb/sq in for outlet pressures adjustable up to 35 lb/sq in, within temperature limits of —40 deg C to 300 deg C. These valves weigh only 0.75 lb each.

(4) MERITS OF THE GNAT

Production

The Gnat's small size, the simplicity of its structures and services, and the extensive use of pressed and formed light-alloy sheet overcome many of the difficulties met with in the production of modern conventional fighters. Forgings and castings are few, and the simple hydraulic, electrical and other services make it possible for sub-assemblies to be fully completed before final assembly.

A typical example of Gnat construction is the wing. This is built in one piece; has a symmetrical section so that many components are interchangeable between port and starboard; has no cut-outs for guns, fuel tanks and undercarriages and, being secured to the fuselage by bolts at only four main points can, if necessary, be fitted shortly before flight.



IN MAN-HOURS, IN THE NUMBER OF JIGS AND TOOLS, AND IN FLOOR SPACE THE GNAT'S PRODUCTION NEEDS ARE BUT A THIRD TO A QUARTER THOSE OF THE CONVENTIONAL FIGHTER. THE DEMAND ON SKILLED LABOUR IS SMALL AND THIS, WITH ITS OTHER ADVANTAGES, MAKES THE GNAT SUITABLE FOR MANUFACTURE IN ANY FACTORY EQUIPPED WITH STANDARD MACHINE TOOLS.

WHERE THE GNAT ALSO SCORES

Judged by conventional fighter standards, the Gnat:—

(1) is superior in rate of climb, manœuvrability and service ceiling, and at least equal in speed and radius of action.

(2) is less exacting in its airfield requirements.

(3) can be transported more easily.

(4) is easier and cheaper to maintain.

(5) has far lower initial and operating costs.

FOLLAND PIONEERS OF THE LIGHT JET FIGHTER

FOLLAND AIRCRAFT LIMITED · HAMBLE · SOUTHAMPTON · HANTS

The de Havilland Aircraft Co. Ltd.
is forming a

NEW DESIGN TEAM

for the structural design of

NEW AND SPECIAL PROJECTS

Structures Engineers and Design Draughtsmen,
not necessarily with aircraft experience,
are invited to make application to
join this select team engaged
on entirely new projects.

Suitable candidates will be interviewed
by the Chief Designer.

Applications should be made in writing, giving
full details of technical qualifications, practical
training and experience to:—

The Personnel Manager,
(Dept. P.1),
THE DE HAVILLAND AIRCRAFT CO. LTD.
HATFIELD, HERTFORDSHIRE

CIVIL AVIATION

NEW U.S. VISCOUNT CUSTOMER?

THE president of Continental Air Lines, Mr. Robert F. Six, arrived in London on November 6th for discussions with Vickers-Armstrongs about a possible order for 15 Viscounts. During the previous visit, last May, Mr. Six booked "a place in the queue" for 15 Viscount 800s and returned to the United States with performance data on which to base a final decision.

This decision has apparently been postponed in the light of the improved output promised by recent development of the Dart turboprop. The version of the Viscount in which Continental are now interested is the 810D, powered by 1,910 s.h.p. Dart RDa.7s, stressed for a gross weight of 65,000 lb and capable of cruising at 360 m.p.h. Installation of RDa.8s, when these 2,750-e.h.p. turboprops become available, would produce a 65/70-seat transport capable of 400 m.p.h. Such an aircraft could, from Continental's viewpoint, be matched against Electras ordered by their competitors, and would have the added attractions of earlier delivery and lower cost.

Newspaper reports of Mr. Six's visit said that Viscounts ordered by Continental Air Lines would cost approximately £1.6m each with spares. This figure should presumably have read $1.6m (£570,000), which is a generous estimate of the cost of a Viscount 810D with full spares provisioning, including spare engines.

SELLING THE HERALD

ACCORDING to a recent Douglas estimate, the number of DC-3s in regular service is more than 1,500. Even allowing for the effects of replacement by larger aircraft, it remains obvious that a fat order-book awaits the manufacturer who succeeds in producing an attractive, economical aircraft designed specifically to replace the DC-3. More than one company has decided, however, that the risks involved are too great to justify construction of privately financed prototypes and the setting-up of a production line in expectation of orders.

As builders of transport aircraft go, Handley Page are not a large concern, and their initiative in producing the private-venture Herald is the more commendable for that reason. Construction of the first prototype was completed within a year at the firm's Woodley, Reading, factory and before the first flight took place at Radlett on August 25th three airlines had signified their intention to buy 29 Heralds. An order for at least six more was placed shortly after the S.B.A.C. Show, at which the new aircraft made a good impression. And last month Handley Page announced the decision to set up a production line for 100 Heralds.

At Cricklewood last week we asked Handley Page's sales manager, G/C. R. C. M. Collard, for a résumé of progress made so far in marketing the Herald. His reply was encouraging.

Negotiations and discussions now under way, we learned, covered a total of 300 Heralds additional to the 35 earmarked for Queensland Airlines, Australian National Airways, Lloyd Aero Colombiano and Air Kruise (Kent). This is not to imply that 335 Heralds are as good as sold; indeed, many of the discussions are only in the preliminary stage. Some of the operators concerned might have decided in principle to buy Heralds but not to commit themselves to a final order until the aircraft had proved itself in scheduled airline service. From the manufacturer's viewpoint, said G/C. Collard, it was indeed fortunate that every operator did not adopt this attitude.

Representatives of three United States local-service carriers have already visited Handley Page to fly in the Herald and the firm is in touch with six others. The prototype was also demonstrated recently to members of the House of Representatives Committee on Inter-State and Foreign Commerce. This was not, as might superficially appear, a routine goodwill visit without a specific objective; the group's members, who displayed a well-informed approach to aviation matters, are concerned with, *inter alia*, subsidies and imports of aircraft (committee members also visited Vickers-Armstrongs at Weybridge).

This American interest in the Herald is interesting, for it indicates that application of the aircraft is by no means confined to undeveloped areas. Handley Page's view is that (a) the Herald is suitable for any operator wishing to carry passengers over the shorter ("branchline") routes in comfort; (b) it is the only choice where routes are undeveloped, entailing short unpaved runways with height and/or temperature limitations; and (c) for developed routes its economics make it the best choice.

The Herald's suitability for undeveloped routes has attracted interest from all parts of the Commonwealth, which includes so many areas relying on aviation as an instrument of development. Two of the many Australian operators serving outback districts have been named as customers, and others are undoubtedly considering the aircraft.

"Flight" photograph

Painted in the colours of Queensland Airlines, the prototype Herald makes an attractive picture. Herald sales progress is discussed below.

G/C. Collard also revealed that there is "considerable New Zealand interest," which must be interpreted as a tactful reference to the possibility of an order from New Zealand National Airways Corporation, now equipped largely with DC-3s. Other possible Commonwealth purchasers are the airlines servicing British territories in Africa and the Middle East (where G/C. Collard is to make a three-week tour during December, in order to meet operators and to extend H.P.'s representation in the area). French colonial operators have shown interest in the Herald, and in South America there are "considerable prospects" beyond the small sale already announced. Nearer home, Handley Page are in close touch with at least five British independent operators, in addition to the one (Air Kruise) whose choice has been published.

Meanwhile, flight-testing of the first prototype is continuing at Woodley under Handley Page's chief test pilot, S/L. Hazelden, and a second prototype will join it next year. The present aim is to obtain a restricted C. of A. by the end of this year, in order to send the first prototype abroad for tropical trials. Some time in 1956, it is hoped, an unrestricted C. of A. will be awarded. One of the prototypes is to be placed in scheduled service with a British independent airline in order to prove its characteristics under route conditions. Deliveries should begin in about two years' time.

Though the first prototype is neither pressurized nor fully soundproofed, airline representatives are reported to have praised its quietness in cruising flight. This achievement G/C. Collard attributes largely to the smoothness of the four 14-cylinder Alvis Leonides Majors.

SAMPLING A PANAM DC-7B

TOURIST-CLASS air travel is today the rule rather than the exception—yet it was only three years ago that it was first introduced by IATA-member airlines. The extra traffic attracted by a 30 per cent lower fare and a few inches less legroom has resulted in steadily improved standards of comfort for the airlines' most important customers: a Douglas DC-7B, for example, as now employed by PanAm exclusively for its trans-Atlantic tourist services, has interior appointments which compare well with typical first-class accommodation of a few years ago. *Flight* took the opportunity to sample the latest Douglas last week, when we were welcomed aboard *Nautilus*, one of the seven 7B Clippers now in service.

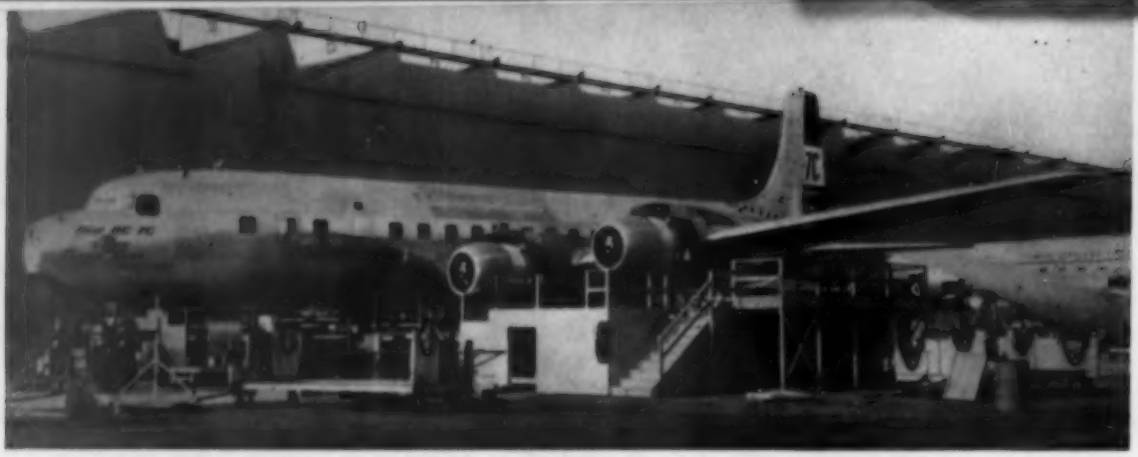
The passenger boards a piston-engined airliner—especially one powered by four mighty 3,250 h.p. Wright Compound engines, prepared to make allowance for noise and vibration. We were, however, pleasantly surprised: even at take-off noise and vibration were not oppressive, and at cruising power almost unobtrusive. Douglas have soundproofed the 7B most carefully, and one looks forward to experiencing travel by DC-7C, in which the engines have been moved further away from the cabin.

The outlook from the centre-section seats is largely one of titanium, which has been used almost entirely for the skinning of the engine nacelles (containing 200-U.S. gallon bag-tanks).

From the rear seats it is possible to study the new flaps which distinguish the 7B from its predecessors. The entire surface has been re-located in relation to the upper wing contour to improve flow in the take-off setting, resulting in a marked advance in take-off performance.

The interior colour-scheme of cream and blue, with wood-veneer panelling on bulkheads, is restful and pleasing; sleeping berths, which are available for first-class operations, are neatly folded into the junction of walls and roof, and do not intrude—indeed, they help to soften the tubular contours of the cabin. Up forward, a small four-seat compartment—ideal for family parties—is an unusual amenity in a tourist aircraft.

PanAm introduced the 7B on its Atlantic routes on June 15th. Its cruising speed of 350 m.p.h. makes it the fastest airliner in service today.



Looking deceptively like its smaller predecessors, this almost-completed Douglas DC-7C had its first airing at Santa Monica recently. Due to fly before the end of the year, it is the first of 102 Seven Seas ordered by ten airlines.

CIVIL AVIATION . . .

SWINGS AND ROUNDABOUTS

THE principle of regulated competition, on which the American air-transport system is based, is defended in a recent statement issued by the Air Transport Association, which represents the C.A.B.-certificated regular carriers. A recent survey of the routes of seven major airlines, the statement says, showed that 147 of the 301 stations served were "either unprofitable to the airlines or so close to being unprofitable as to be questionable." The C.A.B. defines as loss or marginal points airports at which a given airline takes on fewer than 50 passengers daily; a station is defined as the operations of one airline at a given airport. Under a system of free competition, it is pointed out, these marginal points would find themselves with limited scheduled services, or none at all.

At present the C.A.B. demands similar tariffs for similar levels of service between any pairs of points served. To this extent traffic between major centres subsidizes traffic between smaller communities. So far as is possible, licences are awarded on a basis which gives each major airline a fair proportion of "fat" and "lean" routes.

A.T.A. members are undoubtedly concerned at the fact that an irregular carrier, North American Airlines, has succeeded in tapping a substantial share of coast-to-coast traffic, using high-density DC-6Bs. As a result of this unwelcome competition, American Airlines, T.W.A. and United Air Lines were recently forced into introducing coach fares well below previous levels. The legal status of North American's operations has been the subject of lengthy and, so far, inconclusive proceedings; attempts to force the company to change its name—it has no connection with American Airlines or the North American manufacturing concern—have also been unsuccessful.

On the surface, this affair may appear as a clash between a struggling independent company and powerful vested interests. In putting the case for the certificated airlines, the A.T.A. statement is therefore at pains to point out that "If airline revenues from major cities are to be diluted by irresponsible competition, the intermediate cities may lose their air service before they have a chance to prove that they can join the cities that more than pay their way . . ." It adds: "The Civil Aeronautics Act requires that airlines develop an air transport system for the nation as a whole—for the smaller and intermediate cities as well as for the metropolises."

CAMBRIAN AIRWAYS BUY HERONS

A NEW home order for Herons—the fourth placed by a British airline—was announced last week by the de Havilland Aircraft, Engine and Propeller companies. The operators are Cambrian Airways, who have ordered two 15/16-seat Heron 2s. Previous British airline buyers of Herons have been Jersey Airlines, B.E.A. and Dragon Airways. Incidentally, the sale of the 100th Heron—to Braathens S.A.F.E.—was announced a week ago.

Cambrian's new aircraft will join a mixed fleet of Doves, Rapides and DC-3s. They will be used principally on the Cardiff-Bristol-Southampton-Paris and Cardiff-Bristol-Dinard routes. Cambrian have received provisional approval for a high-frequency service between Haverfordwest and London *via* Swansea, and it is likely that both Doves and Herons will be used on this new route. Other points served by the Cambrian network are Liverpool, the Channel Islands and Nice.

A NEW LEARSTAR

DETAILS of a new Lodestar conversion are announced by Lear, Inc., whose Learstar Mk 1 is already well established in the executive market. The Mk 1 Learstar, it may be recalled, is a Lodestar modified to give a higher performance and to meet airliner-category performance requirements (C.A.R. Part 4B). The modification programme, undertaken at Lear's engineering division at Santa Monica, entails an 8,000 hr overhaul, new interior, new radio equipment and instrumentation and a complete change of plumbing and wiring.

The Mk II Learstar is aimed at Lodestar operators unwilling to pay the cost of conversion on this scale but anxious to obtain the improved safety characteristics and some of the performance advantages of the Mk 1. Thus, the Mk II conversion does not involve any change of furnishing, cockpit layout, radio or instrumentation. Among its attractions, as quoted by Lear, are a cruising speed of 260-290 m.p.h., 2,500-mile range at 270 m.p.h., improved stall characteristics and stability, and a single-engined performance "far in excess of requirements."

MIDDLE EAST VISCOUNTS

ROUTES now operated from Beirut by the three Viscounts now in service with Middle East Airlines are as follows: to Cairo (three return services weekly); to Dhahran (three); to Bahrein (one); to Baghdad (two); to Athens and Rome (two). One of the M.E.A. Viscounts, which are on lease from Hunting-Clan, was recently demonstrated to King Saud and representatives of Saudi Arabian Air Lines.

Other news of Middle East Viscounts is that the first of three ordered by Iraqi Airways was delivered at the end of October and that the second was due to follow it last week-end. Iraqi Airways' Viscounts will enter service next month on routes to Beirut, Teheran and Aden; early next year the airline plans to introduce their new aircraft on services to Pakistan and London.

G-AMAV, the V.77 prototype, which is now completing three months of trials in Central Africa, was due to fly from Nairobi to Addis Ababa yesterday for two days of demonstration flying for Ethiopian Airlines.

BREVITIES

FOR the first time since 1939, German pilots are in command of civil aircraft—DC-3s used on Lufthansa's new internal routes. B.E.A. and T.W.A. pilots are still commanding, respectively, the Convairs and Super Connies employed on the international services.

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To help finance their current £125m re-equipment programme, Eastern Air Lines have raised a loan of £32m, repayable over 20 years, from an insurance company. Eastern are expected to announce a jet-transport order before the end of the year.

* * *

During August, the busiest month in the Corporation's history, B.E.A. carried 302,000 passengers and earned £2.6m, 23 per cent more than in August 1954. Over the six-months summer season (April-September) B.E.A. carried 25 per cent more traffic, including just on 1.5m passengers, than in the corresponding period of 1954.

* * *

American Airlines announce the retirement, for health reasons, of Mr. Lawrence G. Fritz, vice-president (flight) since 1945. During the war Mr. Fritz commanded the North Atlantic Division of the U.S.A.A.F. Air Transport Command. His assistant at that time was Mr. T. L. Boyd, who joined A.A. as a first officer in 1934 and who now succeeds Mr. Fritz as v-p. (flight).

* * *

According to Warsaw Radio, the current five-year economic plan for Poland includes the introduction of jet airliners on regular passenger services. The same source said that commercial helicopter services were due to begin next year, and that construction of city-centre heliports was under way; five heliports, it was claimed, had already been prepared in Warsaw alone.

Snow, fir trees, and the Swedish BA-6, described in a news item below.

FROM THE CLUBS

THE trim lightweight in the cool, northern scene above is the BA-6, a new Swedish aerobatic single-seater. The designer is Björn Andreasson who, it may be recalled, was also responsible for the compact little BA-4 single-seat biplane which appeared in 1944.

The BA-6 is of all-wood construction and has a design safety factor of 9.9. Current examples have the 65 h.p. Continental A-65 flat four engine (the 85 h.p. Continental is an alternative). Maximum speed at sea-level is claimed to be 145 m.p.h.. Take-off distance to clear 50ft is 500ft, and landing speed (with flaps) is 34 m.p.h. Range too, is exceptional; with maximum tankage, the still-air distance is 1,200 miles. Plywood covering, except for fabric covered control surfaces, is used throughout. Main dimensions are: span 23ft, length 16ft 5in, height 5ft.

Two enthusiasts—Hugo Ericsson of Tandsbyn and Erik Jonsson of Ostersund—have built BA-6s to date, at a cost of approximately 7,000 Sw.Kr. (£485) each. Time taken for building covered a period of four years. The two machines differ slightly in cockpit-canopy detail, while the ski undercarriage is replaced by normal wheels during the summer season.

FOR many years the Wiltshire School of Flying have maintained that it was impossible for a club to fly more hours in one month than the 627 hr logged during August, 1939, at Thruxton (this having been achieved with the Civil Air Guard scheme in full swing and using two Taylorcrafts, four Piper Cubs and two Moth Majors). In August of this year, however, a new record of 666 hr was set up, using three Austers, four Tiger Moths and two Proctors. September, too, was a good month, 529 hr being logged, and C.F.I. Heaton and instructors Cook, Jennings and Mumtaz were kept extremely busy. A further six M.o.S. scientists from Boscombe Down and Farnborough have begun training towards their P.P.L.s. Thirty-six P.P.L.s were obtained at Thruxton during the first nine months of 1955 (including 14 by A.T.C. cadets), and 18 pupils qualified on the A.B.A.C. wings course.

WINNER of the Yorkshire Aeroplane Club's R.H. Braime Navigation Trophy for 1955 is Ken Trew of Selby. Following the recent "At Home" organized by the neighbouring Yeadon Aero Club, and the Yorkshire Club's success in the bombing competition there, the new "gauntlet" trophy now has place of honour in the club house at Sherburn. The trophy is to be competed for annually by the two clubs.

MAJOR event among the recent activities of the Royal Singapore Flying Club has been the club's move from Kallang to the new Singapore Airport at Paya Lebar. This involved the dismantling of the club hangar at Kallang, its transportation to Paya Lebar and re-assembly, and the construction of extension workshops and a new clubhouse there also. During the re-erection of the hangar, the club's aircraft were housed at Sembawang Aerodrome. The whole of the dismantling and erection work on the hangar has been carried out under the supervision of Jim Satchell, the R.S.F.C. aircraft engineer. Kallang Aerodrome, home of the club for the last 18 years, was also the base for a Government flying training school during the early part of the war, and served as headquarters for the Malayan Volunteer Air Force during the Japanese invasion.

OFFICIAL opening of the Kronfeld Club, for gliding and light-aircraft enthusiasts, is planned for Wednesday next, November 16th, when the Shell films "Air Parade," "The Power to Fly" and "Rig 20" will be shown. On succeeding Wednesdays, talks will be given by John Furlong (Air Touring Around Europe, November 23rd), Charles Brown (Aerial Photography, November 30th), Nick Goodhart (Gliding in the States, December 7th) and C. E. Wallington (Meteorology for Glider and Light-aircraft Pilots, December 14th). The first Christmas party is planned for December 21st. The address of the club is 74 Eccleston Square, London, S.W.1, and membership inquiries should be addressed to Hugo Trotter, 56 Victoria Street, London, S.W.1 (Victoria 6056). The film show and talks begin at 7.30 p.m.

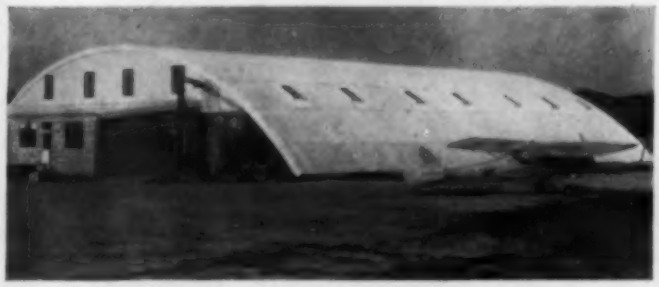
AT the annual general meeting of the Lancashire Aero Club last month, D. L. Armitage was elected president in succession to Fred Dunkerley. The Parnell Trophy, for meritorious service to the club, was presented to J. Y. Simpson. The new committee consists of Messrs. Simpson, B. Hamblett, R. B. Stockfis, M. Barnes and R. Weston. Flying times at Barton for September and October totalled 130 and 139 hr respectively, bringing the total for the first five months of the club's financial year to over 800 hr—an all-time record.

LEAR'S EUROPEAN DEMONSTRATOR

A CESSNA 310 has been delivered to Geneva to be used as an equipment demonstrator by William Lear, chairman of the board of Lear, Inc., during his three-year market-survey in Europe. It is claimed that the aircraft carries the most extensive complement of equipment ever installed in a light twin. It carries the following: Lear F-5 autopilot with height lock, I.L.S. approach coupler and a coupler for flying Omni-ranges and holding preset headings; Lear 3in V.G.I.; a Lear instrument flight system called NAFLI; Lear LTR-800 V.H.F. 800 channel transceiver; Lear LVTR-36 V.H.F. 36-channel transceiver; Lear 5600 M.H.F. receiver; Lear 5636 M.H.F. transmitter; Lear ADF-14C and ADF-15 radio compasses; Collins omni-indicator; Collins glide-path receiver; Collins heading and course selector; and Lear broadband aerial.

Thus impressively equipped, the 310 was flown across the Atlantic by William Lear, Jr., son of the chairman. He made the flight alone from Detroit, stopping at Goose Bay, Bluie West 1, Keflavik and Paris. Total flight time was 25 hr 46 min, giving an average speed of 188 m.p.h. Extra fuel tanks holding 150 gal were carried in the cabin, so that each leg was completed with at least four hours' endurance left. The pilot said that the facilities available, and the reliability of modern light aircraft, were such that an Atlantic crossing of this type was quite easy, especially with the aid of an autopilot.

This new hangar and workshops, with accommodation for some twelve aircraft, has recently been built for the Christchurch Aero Club.



William Lear and his son William Lear, Jr., with the Cessna 310 after the transatlantic flight (described above) from Detroit to Geneva.

The Duke at the Guild

AT the installation—for the second successive year—of Capt. J. C. Harrington as Master of the Guild of Air Pilots and Air Navigators of the British Empire, H.R.H. the Duke of Edinburgh, who is the Grand Master, expressed some forthright views on London's air travel facilities. The Duke's observations were particularly significant in view of the presence of the Lord Mayor, Aldermen and Sheriffs of the City of London in his audience.

After referring to the admission of the Guild as one of the City's livery companies, the Duke said that it was certain that the air would prove more and more useful to London's merchants and businessmen. But there was a snag that must be overcome, and overcome soon, if the City was to reap any real advantage. "Air terminals," he said, "are too far away in time. It is bad enough trying to get to the railway stations in London; just imagine how much worse it would be if they were ten miles out."

Obviously, he continued, conventional aircraft needed a lot of runway and would continue to do so. But there were other ways of speeding both goods and passengers on their way to the main airfields: "We ought to have a direct rail link with London Airport, and I for one cannot understand why we have not got one already."

The Duke added that we should also be thinking seriously about the possibilities of landing sites on the tops of the big London stations, "not only for helicopters, but also for fixed-wing aircraft designed for short landings and take-offs."

In conclusion, the Grand Master said that in the past, the Guild had been mainly concerned with the well-being of pilots and navigators. Now it had the added responsibility of fostering and furthering the interests of the City of London.

Thanking the Duke, the Master said that the Guild would do its utmost to be worthy of the trust of Livery. He spoke appreciatively of the positive and active interest which the Duke as Grand Master took in flying.

On arrival at Grocers' Hall for the ceremony, the Duke of Edinburgh was welcomed by the then Lord Mayor of London, Sir Seymour Howard, and the Master of the Guild, Capt. J. C. Harrington

At the installation ceremony it is customary for several annual awards to be presented, and on Friday these presentations were made by His Royal Highness. He presented the Cumberbatch Trophy to Silver City Airways, who have gained it by reason of their remarkable safety record; A. Cdre. G. J. Powell (managing director) received the award. The Brackley Memorial Trophy for achievement in the operation of flying-boats went to R.A.F. Station Pembroke Dock (Nos. 201 and 230 Sqns.), and was received by the officer commanding, G/C. P. A. Lombard; and to W/C. R. P. Beamont, of English Electric, the Duke handed the Derry and Richards Memorial Trophy for outstanding achievement in experimental flying. Before the presentation of the awards, it was announced that honorary membership of the Guild had been conferred on Mrs. F. Brackley.

AIRWORK'S NAVAL AIRLIFT

FOR the first time in Naval history, a cruiser is to be re-commissioned entirely by air. The ship is H.M.S. *Newcastle*, at present in Far Eastern waters, and Airwork, Ltd., have been chosen to perform the airlift, involving the movement of more than 1,500 officers, petty officers and ratings between London and Singapore. The airlift is due to begin shortly with the departure from London Airport of a 62-seat Hermes and it is expected that the change-over of crews will be completed within fifteen days.

In the past, it has been the normal practice for Her Majesty's ships to return to this country for re-commissioning. The new procedure will save about eight weeks per man in service availability, yet, say Airwork, it will cost no more than sending a surface troopship out with the new crew and back with the old crew.

A DISTINGUISHED DAKOTA

DAKOTA KN 628, for many years Field Marshal Lord Montgomery's personal aircraft, has been retired from service after completing 2,447 flying hours. Many other Dakotas—especially those in commercial use—have lived far longer lives, but none can have seen more post-war history in the making.

This lease-lend aircraft was provided for the personal use of Field Marshal Montgomery in July 1945 on his appointment as Military Governor of the British Zone of Germany. It replaced another, which he had used since 1943 and which had been destroyed on the ground by the Luftwaffe in January 1945. During the next ten years KN 628 was destined to weave an almost endless pattern over Western Europe and the Middle East. Piloted by S/L. G. H. Duncan, it was based in Germany, and scarcely a day passed without the Field Marshal using the aircraft on his duties up and down that battle-scarred country. In June 1946, when the Field Marshal was recalled to England to become C.I.G.S., KN 628 was transferred to No. 24 (Commonwealth) Squadron, where it became one of a pool of V.I.P. aircraft. In October 1947 it flew H.R.H. Princess Margaret to Belfast for a ship launching, but most of its missions were on sterner business; piloted now by F/L. George Taylor, it carried at one time or another almost all the members of the Cabinet.

In October 1948 Field Marshal Montgomery was appointed Permanent Military Chairman of the Western Commanders-in-Chief Committee, and once again he was given the use of KN 628, so that it resumed its familiar flight pattern between London, Paris and capitals of the Benelux countries; and in 1949, with the signing of the North Atlantic Treaty, Norway, Denmark, Italy and Portugal came within its radius.

Early in 1951 the last phase of the Dakota's service started with the appointment of Lord Montgomery as Deputy to the Supreme Allied Commander in Europe. Under the captaincy of S/L. J. T. Haughton, 530 operational flights of varying duration were successfully completed and on only one occasion was a delay caused by mechanical trouble.

KN 628 was originally converted for its V.I.P. rôle by a maintenance unit at Courtrai in Belgium in July 1945. It has a forward eight-seat cabin and a rear cabin containing seven bench seats and a steward's compartment; by modern standards its furnishing is austere. Another Dakota, KN 645, has now been earmarked for Lord Montgomery's personal use.

BRITANNIA PROGRESS REPORT

(*Continued from page* 735)

that the Corporation expected to begin Britannia services in the spring of 1956. But it now seems that the date will be put back a few months, largely as a result of the icing-trials delay and also, perhaps, by the need to embody modifications arising from the past summer's intensive trials.

Postponement of the Britannia's appearance on the B.O.A.C. network will inevitably evoke disappointment and perhaps a renewal of some of the criticisms levelled at Bristols earlier this year, when the DC-7C order was placed. Such disappointment is natural, though we believe that manufacturer and operator might do much to assuage it by the publication of more frequent and more comprehensive progress reports.

Be that as it may, it must be appreciated that development problems cannot be avoided with a project of Britannia scale—a new aircraft/engine combination of unprecedented capacity, complexity and revenue-earning potentiality. The magnitude of the problems and their ultimate effect on target dates can be seen, however, only in retrospect. Because it is of orthodox appearance, the Britannia is all too easily taken for a run-of-the-mill long-range transport. It has no single hallmark to stamp it as a potential world-beater. Taken together, however, its range, speed, capacity and comfort promise a major advance in civil aviation—and the birth of a new family of high-performance, low-cost transport aircraft.

Two British masterpieces—the one in stone, the other in metal—are Lincoln Cathedral and the Avro Vulcan. The third production Vulcan is seen sweeping past the cathedral as though in salute to the Bomber Command Memorial which it enshrines.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

Cathedral Memorials

THE stained-glass window in Ely Cathedral, a picture and description of which appeared in these columns on October 28th, was unveiled last Sunday by A.V-M. A. McKee, A.O.C-in-C. Transport Command. More than 3,000 people attended the service, over two thousand of them relatives of those who died.

On the same day the Duke of Edinburgh went to York Minster to unveil another memorial to 18,000 airmen from the groups based in North-Eastern England who lost their lives during the war.

For the ceremony at Ely the Pathfinder Association identified all the names of those who were lost from No. 8 Group, the Pathfinder Force, and wrote to over 5,000 relatives and next of kin. Tickets were sent to those who could attend, and financial assistance given to those who could not otherwise have afforded to do so.

No. 502 Sqn. Cross-country

LAST Saturday F/O. J. Cole of No. 502 (Ulster) Sqn., R.Aux.A.F., flew from Aldergrove to Belfast, Cardiff, London, Edinburgh and back to base in 2 hr 15 min in a Vampire. On landing from the 850-mile flight he was welcomed by Lord Brookeborough, Prime Minister of Northern Ireland and the squadron's Honorary Air Commodore, who had initiated the scheme through which F/O. Cole and many others had been able to join the squadron. They have served with Queen's University Air Squadron and completed R.A.F. wings courses in England.

The Hack Trophy

BIRMINGHAM University Air Squadron has won the Hack Trophy as the best of the 17 university squadrons in 1955. Second and third were Nottingham and St. Andrews respectively.

R.N.Z.A.F. Appointment

IT is announced that G/C. T. F. Gill, D.S.O., Deputy Chief of Air Staff of the R.N.Z.A.F., has been selected to attend the 1956 course at the Imperial Defence College, London. After completing the course in a year's time he will be appointed to head the New Zealand Staff Mission in Washington for three years. G/C. Gill joined the R.N.Z.A.F. in 1938 and served during the war with the R.A.F. in both fighter and bomber units.

No. 812 Sqn. Reformed

ON Monday last, No. 812 Sqn., Fleet Air Arm, was reformed at R.N.A.S. Eglinton, Northern Ireland, with Gannets. The unit was first formed in 1933. It will become part of a new carrier air group including squadrons of Sea Hawks and Wyverns. No. 812 was aboard H.M.S. *Ark Royal* when she was sunk in the Mediterranean during the war, and was re-equipped in Gibraltar and re-embarked within two days.

The new C.O. is Lt-Cdr. G. D. Luff, who was awarded the D.F.C. for his work as senior observer of the R.N. helicopter squadron operating in Malaya.

Aden Levies Rearmed

REORGANIZATION of the Aden Protectorate Levies, who are frequently in action against the dissident tribesmen of the Western Aden Protectorate, includes the formation of a new armoured car company, No. 10. Some of the unit's Ferret scout cars, each mounting a 0.30in machine gun, were flown out by Hastings aircraft, while others were shipped by sea. The Levies are also carrying out troop trials with the new F.N. rifle. These factors, together with increased pay, have led to a considerable increase in recruiting.

National Service Navigators

THE opportunity of training as commissioned navigators during National Service with the Royal Air Force is now being re-opened, with flying training in Canada. Those wishing to take advantage of this opportunity may apply before call-up or in the first three weeks of their National Service. Qualifications required are the same as for National Service pilots —a General Certificate of Education with passes at ordinary level in English and two other subjects, or its equivalent, medical fitness, and ability to pass the selection tests of the Aircrew Selection Centre.

Selected candidates will begin their training with a twelve-week course at R.A.F. Kirton-in-Lindsey, Lincs., for initiation into the R.A.F., instruction in administration, law and discipline, and officer training generally.

On successful completion of this course, candidates will be granted commissions as

The Duke of Edinburgh in procession on his way to York Minster to unveil the memorial to 18,000 airmen who lost their lives while operating with groups stationed in North-East England during the war.

SERVICE AVIATION . . .

Acting Pilot Officers and will spend some ten months in Canada training alongside men of the Royal Canadian Air Force and other NATO countries.

St. Edward's Memorial Window

A STAINED-GLASS window commemorating old boys of St. Edward's School, Oxford, who lost their lives while flying with the R.A.F. during the war is to be unveiled in the School Memorial Library on November 19th.

Designed by Mr. Hugh Easton, who was responsible for the Westminster Abbey and Biggin Hill Battle of Britain memorial windows, it will be unveiled by Air Chief Marshal Sir John Whitworth Jones, a former Member of the Air Council and a Governor of the School. It has been given by the Air Council, and paid for by money allocated from the Royal Air Force Prize Fund. It will be formally presented by the Air Member for Personnel, Air Chief Marshal Sir Francis Fogarty.

The Air Council has also endowed a scholarship of £40 a year, named after W/C. G. P. Gibson, V.C., D.S.O., D.F.C., an old boy of the school. Better known as Guy Gibson, he won the Victoria Cross after leading No. 617 Squadron in the attack on the Möhne and Eder dams in 1943. The scholarship award will be made to the son of a serving officer of the R.A.F. for the duration of the time at the school, the first being awarded in September 1956. A prospectus giving full details may be obtained from the Warden, St. Edward's School, Oxford.

The Whittle Prize

FIRST winner of the Whittle Prize, given to the R.A.F. Technical College, Henlow, by A. Cdre. Sir Frank Whittle, is ex-Technical Cadet (now P/O.) Donald James Grant. Subject of his essay was electrical power systems for future Service aircraft. In offering the prize to the College Sir Frank Whittle wrote: "A preliminary idea is that it should be used for an essay on 'future developments in aircraft design,' the title I used for my Cranwell thesis which really marked the starting point of my work on the jet engine." The prize, to be competed for annually by Henlow Technical Cadets in the third and last year of their training, consists of suitably inscribed and specially bound books. P/O. Grant's essay will appear in the October issue of the R.A.F. Technical College Journal. He was educated at Southfield Grammar School before entering the College.

Mr. Peter Birch, D.F.C. (right), Rolls-Royce representative in Australia, presents to A.V-M. A. M. Murdoch, C.B.E., the Rolls-Royce Shield, to be awarded annually to the best engineering apprentice at the R.A.A.F. School of Technical Training at Wagga.

R.A.F. Winter Sports

OPEN to all past and present members of the three Services, their families and friends, is the Winter Sports Holiday Scheme of the Royal Air Force Ski and Winter Sports Association. This year the Association has seven parties going out to Zermatt between December 22nd and March 30th. Travel will be by rail or air, and whenever necessary more than one aircraft will be used. Advantages are the unlimited use of all ski lifts and chair lifts, as well as the full length of the Gornergrat mountain railway. Four hours' ski school is included every day for ten days. During January and at the end of March the inclusive charge is £38 10s, including third class return fare. The air fare and the extra night in Zermatt is £2 15s more. Brochures concerning the scheme are obtainable from S/L. P. D. O. Coryton, Honorary Secretary, R.A.F. Ski and Winter Sports Association, No. 1 Officers' Mess, R.A.F. St. Athan, Barry, Glamorgan, South Wales.

Exercise "Cracker Jack"

AN air defence exercise will be conducted jointly this winter by the United States and Canada. In order to lend a note of realism to the exercise, the opening date will be announced only after the exercise has begun. The purpose of "Cracker Jack" is to provide radar tracking and interception practice to defending forces. Elements of the U.S.A.F.'s Strategic Air Command will penetrate the northern radar screen.

Land/Air Warfare Show

DURING a senior officers' study period at the R.A.A.F. School of Land/Air Warfare, a demonstration of various tactical techniques was given at the Morna Point operational training area near Newcastle, N.S.W.

Australian Canberras made dummy medium-altitude bombing runs and were attacked by Avon-Sabres. Hastings carried out paratroop and supply drops, Meteors fired rockets and dropped napalm; and it was reported that jeeps and light field guns were dropped by parachute from R.A.A.F. Lincolns.

R.A.F. Appointments

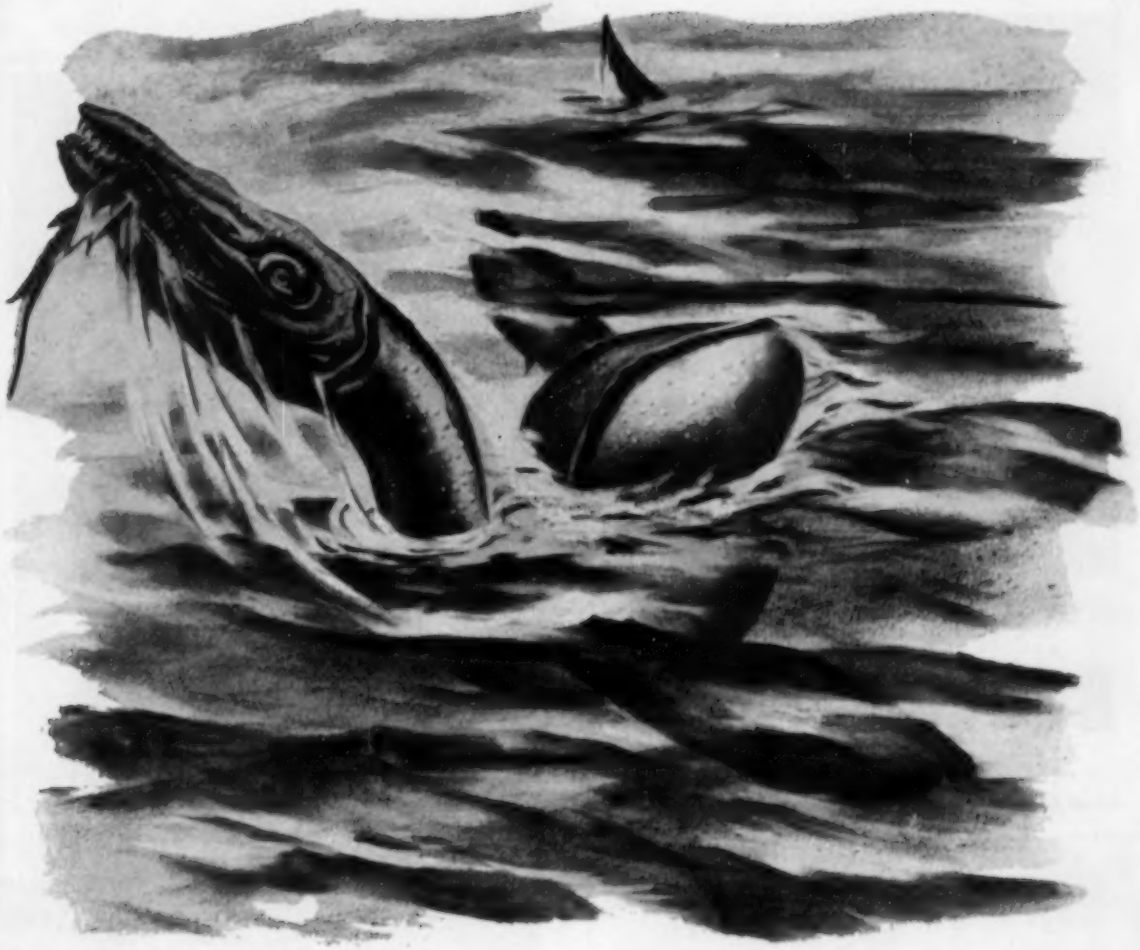
THE following continues recent lists of Royal Air Force appointments as announced by the Air Ministry:—

G/C. D. L. Amlot, C.B.E., D.F.C., A.F.C., to R.A.F. Staff College, Bracknell, for directing staff duties; G/C. G. D. Garvin to H.Q. No. 25 Group, for air staff duties; G/C. D. I. P. Macnair to H.Q. 2nd Tactical Air Force, for joint liaison staff duties; G/C. A. B. Riall, O.B.E., to R.A.F. Regiment Depot, to command; G/C. P. G. St. G. O'Brian, O.B.E., D.F.C., to H.Q. Fighter Command for air staff duties; G/C. R. J. Oxley, D.S.O., O.B.E., D.F.C., to R.A.F. Dishforth to command; G/C. C. A. Watt to R.A.F. West Kirby to command; G/C. A. H. McM. Hely, O.B.E., to H.Q. Far East Air Force for administrative staff duties; G/C. T. S. Kennedy, O.B.E., to H.Q. Allied Air Forces Central Europe for staff duties; G/C. I. B. Newbigging, D.F.C., to Air Ministry for duty in Department of C.A.S.

Reunion

A REUNION dinner of No. 79 (F.R.) Squadron is being held at the Officers' Mess, R.A.F. Wunstorf, on November 26th. Any ex-squadron officers wishing to attend will be most welcome. Further information can be obtained from the squadron adjutant at R.A.F. Laarbruch, 2nd A.T.A.F., B.A.O.R. 43.

With one of the squadron Meteor 8s at Biggin Hill are these officers of No. 615 Squadron, R.Aux.A.F.: (L. to r.) F/L. J. W. C. Judge, F/O. G. I. Smith, S/L. R. A. Eeles (commanding officer), F/L. P. V. Pledger, F/L. M. A. D'Arcy and F/O. J. A. Vivian. Leader of the aerobatic team is F/L. Judge. His No. 2 is F/O. Vivian, No. 3 F/O. Smith, and No. 4 F/L. Pledger.



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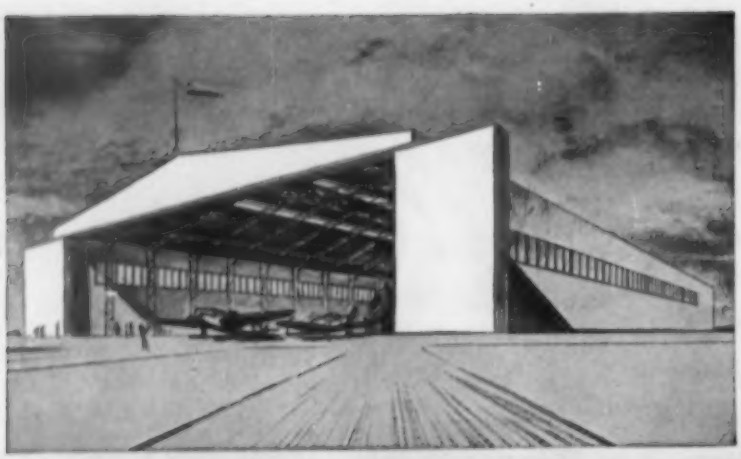

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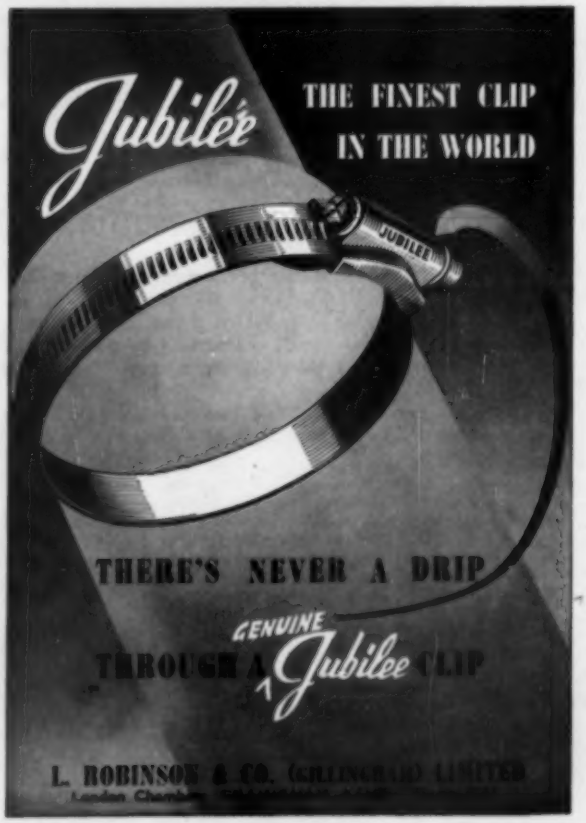

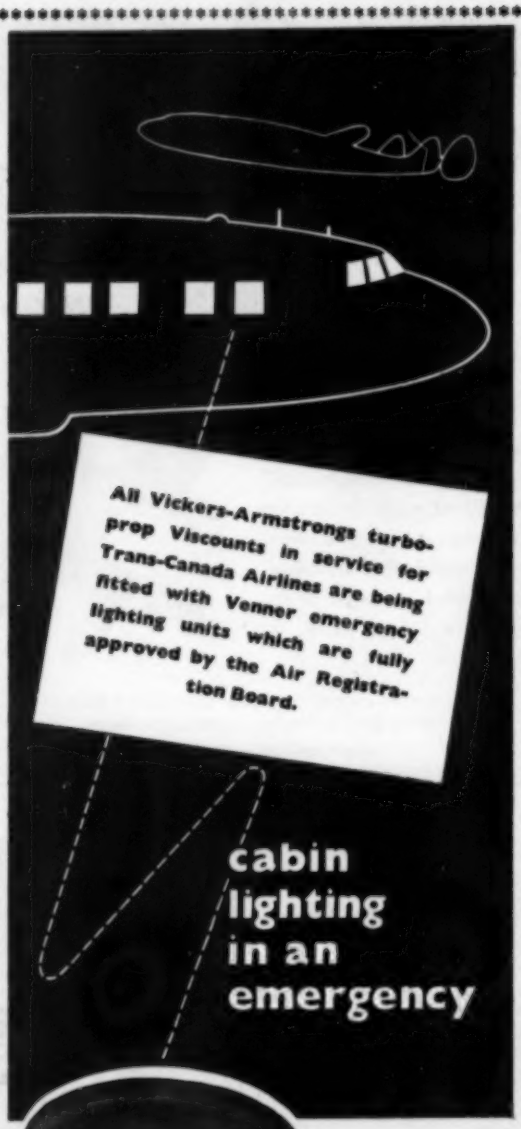

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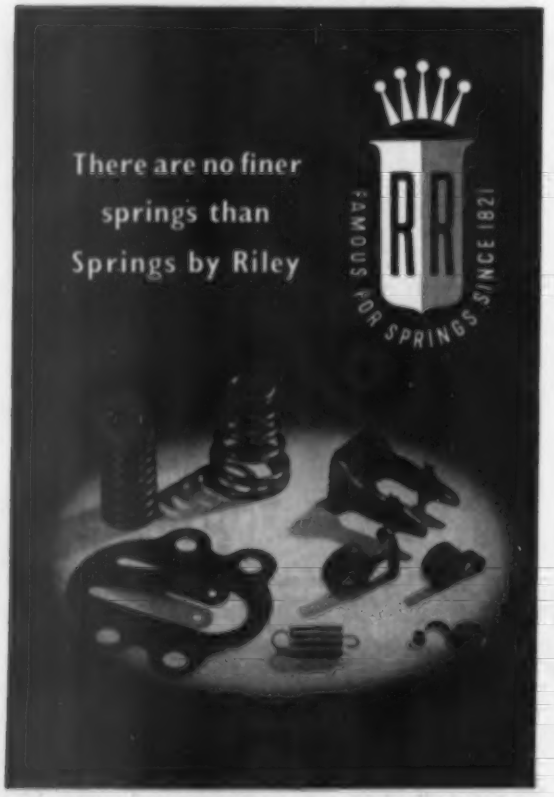

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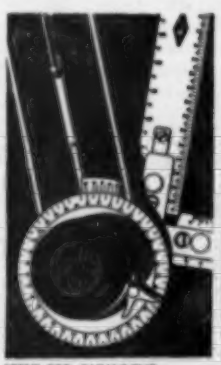

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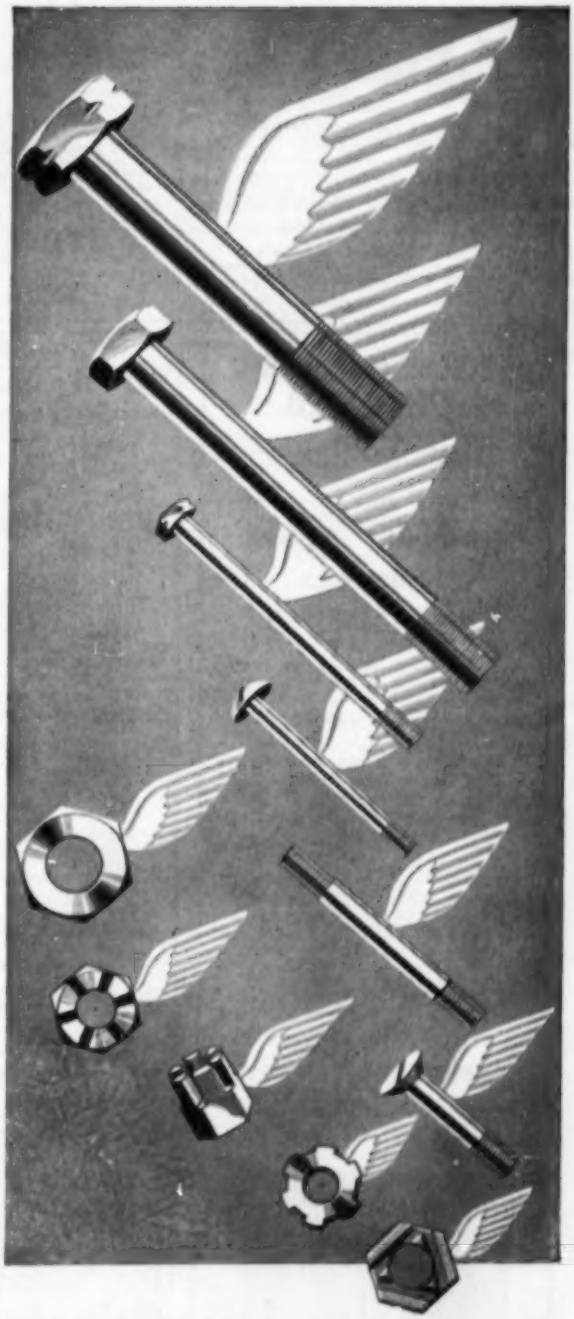

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APPLICATION No. 673. From Cambrian Airways, Ltd., of Cardiff (Rhoose) Airport, Near Barry, Glamorganshire, for a Seasonal Normal Scheduled Service to be operated with Dakota, Dove and Heron aircraft for the carriage of passengers, supplementary freight and mail between Southampton (Eastleigh) and Dinard (Pleurtuit) at an initial frequency of two return flights weekly increasing in accordance with demand during the season from May to September inclusive each year for a period of 10 years, commencing 1st May, 1956.
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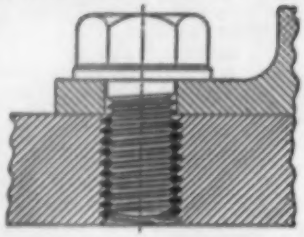

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TO B.S. SPECIFICATION S.P.47

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PUBLIC ANNOUNCEMENTS

(Continued from foot of column 3, page 33)

APPLICATION No. 674. For a service to be operated with Dakota and Viking aircraft in conjunction with Tartan Arrow (Continental), Ltd., between London (Blackbushe) and Innsbruck (Hötting) at a frequency of one return flight weekly to be operated from Mondays to Fridays inclusive during the season from May to September inclusive each year, commencing 1st May, 1956.

APPLICATION No. 675. For a service to be operated with Viking aircraft in conjunction with Sir Henry Lunn, Ltd., between London (Blackbushe) and Bordeaux (Merignac) at a frequency of two return flights weekly, to be operated on Fridays, Saturdays, Sundays or Mondays during the season from March to October inclusive each year, commencing 1st March, 1956.

APPLICATION No. 677. For a service to be operated with Viking aircraft in conjunction with Wenger Airtours, Ltd., between London (Blackbushe) and Beauvais (Tille) at a frequency of from one to four return flights weekly, to be operated Saturdays, Sundays and mid-week during the season from May to October inclusive each year, commencing 1st May, 1956.

APPLICATION No. 676. From Dan-Air Services, Ltd., of Bilbao House, 36/38, New Broad Street, London, E.C.2, for a Seasonal Inclusive Tour Service to be operated with Dakota aircraft in conjunction with Lisonne Lindeman (London), Ltd., for the carriage of passengers and supplementary freight between London (Blackbushe) and Cologne at a frequency of 15 return flights weekly, to be operated on Mondays, Thursdays and Saturdays during the season from May to September inclusive each year, for a period of seven years commencing May, 1956.

APPLICATION No. 678. From Hunting-Clan Air Transport, Ltd., of 72, Wigmore Street, London, W.1, for a Seasonal Inclusive Tour Service to be operated with Viking aircraft in conjunction with Wings, Ltd., for the carriage of passengers between London Airport and Madrid at a frequency of one return flight fortnightly, to be operated on Sundays, during the season from June to September inclusive for a period of one year commencing 3rd June, 1956.

APPLICATION No. 679. From British European Airways Corporation of Keyline House, Ruislip, Middlesex, for a Normal Scheduled Service to be operated with Pionair, Elizabethan and Viscount aircraft for the carriage of passengers, supplementary freight and mail between Manchester and/or Birmingham and Dusseldorf at a frequency according to traffic demand, for a period of 10 years commencing 1st April, 1956.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on 30th July, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3, Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained.

WHEN an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council should reach them within the period allowed for the making of representations or objections.

THE Air Transport Advisory Council also give notice that the following applications from Eagle Aviation, Ltd., of 29, Clarges Street, London, W.1, for Inclusive Tour Services have now been withdrawn.

APPLICATION No. 618. For a service in conjunction with Sir Henry Lunn, Ltd., between London (Blackbushe) and Geneva.

APPLICATIONS Nos. 637 and 645. For services in conjunction with Co-operative Travel Service (C.W.S., Ltd.) and Sir Henry Lunn, Ltd., respectively, between London (Blackbushe) and Turin (Caselle). Application No. 618 was advertised in "The Times," "The Aeroplane" and "Flight" on 30th September and Applications Nos. 637 and 645 on 7th October, 1955.

IN addition, Application No. 682 from Hunting-Clan Air Transport, Ltd., for an Inclusive Tour Service in conjunction with Wings, Ltd., between London Airport and Barcelona has now been withdrawn. This application was advertised on 9th September, 1955.

[4466

PUBLIC APPOINTMENTS

MINISTRY OF SUPPLY requires Engineers (aeronautical, mechanical, electrical) at various experimental establishments chiefly near Farnborough, Hants., Amesbury, Wilts., Aylesbury, Bucks., Bedford and at London headquarters, for research and development work on guided weapons, rockets, gas turbines, armoured fighting vehicles, and aircraft and aircraft equipment including flight test work. Quals. —Higher School Cert. (Science) or equivalent. An H.N.C. or pass degree in engineering may be an advantage and some experience in the duties indicated is desirable. Salary according to age, experience, etc., within ranges: Assistant Experimental Officer £320 10s. (age 18) to £700 (London), £306 10s. to £670 (Provinces); Experimental Officer (min. age 26)—£790 to £960 (London), £745 to £920 (Provinces). Women's salary subject to equal pay scheme. Application forms from M.L.N.S., Technical and Scientific Register (K), 26, King Street, London, S.W.1, quoting C771/5A.

[4376

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MINISTRY OF SUPPLY, Aeroplane and Armament Experimental Establishment, Boscombe Down, Wilts., requires Engineers, Physicists and Mathematicians for assessment of handling and performance characteristics of aircraft including helicopters, by flight trials. Quals.: H.S.C. (Science) or equivalent, but degree or H.N.C. may be an advantage. Flying duties may be involved, and some experience in flight test work desirable. Appointments according to age, experience, etc., as Experimental Officer (min. age 26) or Assistant E.O. Salary within ranges, E.O. £745-£920; A.E.O. £306 10s. (age 18)-£670. Equal pay scheme. Application forms from M.L.N.S., Technical and Scientific Register (K), 26 King Street, London, S.W.1, quoting A 392/5A. Closing date November 25, 1955. [4454

METEOROLOGICAL OFFICE, Scientific Officers. The Civil Service Commissioners invite applications for permanent posts. Early application is advised. The duties include research in atmospheric physics, covering the study of cloud structure, synoptic and dynamical meteorology, large and small scale diffusion and turbulence, climatology, and development of instruments. There is a limited number of posts for forecasting work at the more important centres. Successful candidates will be given a course in meteorology before being assigned to a research or forecasting establishment for further training and experience. In some instances candidates with national service obligations can be commissioned in the R.A.F. for forecasting duties at R.A.F. stations. Further information may be obtained from the Director, Meteorological Office, (M.O.10), Air Ministry, Kingsway, London, W.C.2. CANDIDATES must be between 21 and 28 during 1955 (up to 31 for permanent members of the Experimental Officer class). They must have a First or Second Class Honours degree preferably in physics or mathematics. Salary scale (men in London) £513-£925, somewhat lower in provinces. Women's salaries lower but being improved under equal pay scheme. Promotion prospects to Senior Scientific Officer (£1,070-£1,245), and higher posts. APPLICATION forms from Civil Service Commission, Scientific Branch, 30, Old Burlington Street, London, W.1, quoting No. 852/55. (Met.) [4463

MINISTRY OF SUPPLY requires Technical Authors at Chessington, Surrey, to prepare and/or supervise the preparation of Services handbooks on all aspects of aircraft including engines, armament, instruments and electro-mechanical and electronic equipment. Qualifications: British of British parents. Recognised engineering apprenticeship or equivalent in electronics. Practical experience in one of fields concerned. Knowledge Services technical procedure and experience technical authorship or instructing in technical subjects advantageous. H.N.C. or O.N.C. or City and Guilds or equivalent qualification desirable. Vacancies in two grades at salaries within £705 (age 30)-£831 p.a. or £831-£1,025 p.a. Not established but opportunities to compete for establishment may arise. Application forms from M.L. & N.S., Technical and Scientific Register (K), 26 King St., London, S.W.1, quoting D 492/5A. [4453

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AIRWORK, LTD., require Q.F.I./Staff Pilot for Meteor, Venom and Attacker aircraft. Apply Chief Pilot, R.N.A.S., St. Davids, Nr. Haverfordwest, Pembs. [4459

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TRANSAIR LIMITED, Croydon Airport. A limited number of vacancies exist for first officers. Minimum requirements, commercial licence with instrument rating I, R/T endorsements.

APPLY in writing to operations Manager. [4448

FLIGHT Engineers required for Viking, York and Viscount aircraft. Minimum qualifications "A" and "C" licences on at least one of the above types. Good pay and conditions. Write Box No. F 918, LPE, 55 St. Martin's Lane, London, W.C.2. [4387

RADIO Mechanics (experienced) urgently required at Stansted Aerodrome. Excellent rates of pay and conditions of service. Sick pay. Hostel accommodation available. Apply to Personnel Manager, Skyways, Ltd., Stansted Aerodrome, Essex. [4462

ESTIMATOR required for a company manufacturing Aero Engines in the West of England. Experience in precision engineering work essential and sheet metal work experience an advantage. A knowledge of M.o.S. technical cost procedure is desirable.

APPLICATIONS, which will be treated in the strictest confidence, should give details of previous experience and positions held, together with salary required, and should be addressed to the "Personnel Manager," Box No. 7493. [4464

GOOD general aircraft draughtsman required. Must be able to use his initiative and liaise with aircraft constructors. Knowledge of stressing an advantage. Hunting-Clan Air Transport, Ltd., 5 Fitzhardinge Street, W.1. [4455

A.I.D. Inspector required by expanding Electrical Instrument Component Manufacturers in South Midlands. Successful applicant will be required to build up and operate efficient A.I.D. Inspection department. Apply stating full particulars to Box 7428. [4451

A SENIOR Development Engineer is required for investigation of high altitude problems relating to aircraft electrical equipment. Candidates should possess engineering degree although those with Higher National Certificate will be considered.

GOOD working conditions and prospects; superannuation scheme; sports club and staff restaurant. Housing would be available to suitable applicant, preference being given to those registered on an approved housing list in the London area.

APPLICATIONS in writing to:—Personnel Manager, Rotax, Ltd., Maylands Avenue, Hemel Hempstead. [4450

TECHNICAL ASSISTANTS required for interesting and varied work in Heat Exchange Test Department. H.N.C. standard. Post graduate experience also offered in this field. Apply giving age, experience, salary required, etc., to Delaney Gallay, Ltd., Edgware Road, Cricklewood, N.W.2. [4436

ANY First Officer holding Senior Commercial Licence with Instrument Rating should answer this advertisement if interested in possible promotion to Captain. Vacancies also for qualified Captains to fly Dakota and Marathon aircraft on Charter and Scheduled Services. Derby Aviation Ltd., Burnaston Airport, Derby. [4407

THE College of Aeronautics have vacancies for aircraft fitters (airframe and engine), electricians and instrument repairers, for interesting work on new projects including jet aircraft. Five day week. Staff pension and sick pay scheme. Good holidays. Travelling allowance. Attractive working conditions. Staff canteen. Apply, giving full particulars of qualifications and experience, to the Chief Clerk, The College of Aeronautics, Cranfield, Bletchley, Bucks. [4456

ROCKETS. Manufacturers of Rocket Propulsion Engines have two vacancies for Mechanical Engineers for the design of test equipment. Applicants must have a Degree or H.N.C. Salary £700-£850 depending on experience. Three vacancies for Electronic Engineers. Applicants must have at least a H.N.C. Salary £600-£750. Applications quoting ME/EL/R to Box 7399. [4444

ARMSTRONG SIDDELEY MOTORS have an immediate vacancy for an Instructor in their Gas Turbine School. Candidates must be a trained Instructor (preferably ex-service) who has passed one of the Instructional Technique Courses, and should have done some instruction on engines, preferably with some jet experience. Apply in detail to Reference I/2, Personnel Manager, Armstrong Siddeley Motors, Coventry. [4404

PLANNING engineers. Light engineering firm engaged on interesting development work has vacancies for planning engineers, for machine shop and electrical shop. Only those with sound practical experience need apply. Attractive salaries will be paid to suitable applicants. Apply in first instance to Planning Engineer, M.L. Aviation Co., Ltd., White Waltham, Maidenhead, Berks., giving full details of technical qualifications and practical experience. [4423

TECHNICAL Author required for publications department of an advertising agency, having a flair for succinct technical writing on mechanical, electrical and aeronautical subjects. Excellent opportunity for young man with wide theoretical and practical knowledge interested in modern technical publicity and engineering writing. Write, giving full details of education, age and experience to The Secretary, Roles & Parker, Ltd., Rapier House, Turnmill Street, E.C.1. [4458

WANTED, DRAUGHTSMEN to design in aluminium for sales development. Must possess Higher National Certificate in Mechanical Engineering. Location Banbury. Good working conditions and pleasant surroundings. Attractive starting salaries offered up to £800 p.a. with prospects of promotion from drawing board. Pension plan in operation. Send brief details of qualifications and experience to Northern Aluminium Co., Ltd., Bush House, Aldwych, London, W.2. [0348

SENIOR and Intermediate Design Draughtsmen with aircraft and mechanical engineering experience required. The work will interest men who can apply their design ability to the development of new equipment which has a steadily growing application. Pleasant working conditions. Pension scheme. House purchase assistance available. Within easy reach of Bournemouth. Special transport facilities. Apply in writing to Personnel Manager, Flight Refuelling Ltd., Tarrant Rushton Airfield, nr. Blandford, Dorset. [4417

BRITISH WEST INDIAN AIRWAYS, Trinidad, require Inspectors "A" and "C" licensed. Applicants should have not less than three endorsements on their licences applicable to the following aircraft types and engines. Viking, Viscount and Dakota airframes, Dove, Hercules, P. & W. 1830 engines. Applicants must have endorsements covering at least one type airframe and engine. Salary for these positions commences at £62 per month rising to £94 per month plus Cost of Living Allowance of £9 per month. Applications to Personnel Officer (Associated Companies), B.O.A.C., Stratton House, Stratton Street, London, W.1. [4445

THE FAIREY AVIATION COMPANY, LTD. has vacancies for aircraft and helicopter fuel systems development engineers. Candidates should preferably be of Higher National standard and will be engaged on full scale rig tests simulating flight conditions and development of fuel systems components. A working knowledge of aircraft fuel systems and components is essential. Pension scheme. Applicants should write to the Personnel Manager, The Fairey Aviation Co., Ltd., Hayes, Middlesex, quoting reference FS/2. [4427

WEST AFRICAN AIRWAYS CORPORATION have vacancies for First Officers and Captains based in Lagos. Applicants should hold Airline Transport Pilot's Licence but Senior Commercial Pilot's Licence with Instrument Rating would be acceptable for the filling of First Officer vacancies. Experience on Bristol 170 Freighter, Dove, Heron and Dakota aircraft a desirable qualification. Salary rates and conditions of service are good. Applications in writing to Personnel Officer (Associated Companies), B.O.A.C., H.Q. Building, London Airport, Feltham, Middx. [4401

THE Research Laboratories of S. Smith & Sons (England) Ltd., situated in the Cheltenham area, have a number of vacancies for project officers, to supervise the design and testing of auto pilot installations in new types of aircraft. Previous experience desirable. Applicants should also hold an engineering degree, H.N.C. or equivalent qualifications and should have some knowledge of aerodynamics. Salary £800—£1,200 per annum according to age, experience and ability. The posts are permanent and pensionable, and assistance in obtaining a house will be given to the successful applicants.

WRITE for application form to Personnel Manager, S. Smith & Sons (England), Ltd., Bishop's Cleeve, Near Cheltenham, quoting ref: CHR.14. [4439

ARMSTRONG SIDDELEY MOTORS have vacancies for both senior and junior engineers for investigation of vibration problems on gas turbine development engines. Degree or H.N.C. in Mechanical Engineering or Electrical Engineering are essential. Electrical Engineers should have some mechanical engineering experience. Applicants must be capable of using necessary recording equipment. Salaries commensurate with qualifications and experience together with good pension scheme. Applications to Reference CG/VP, Technical Personnel Officer, Armstrong Siddeley Motors, Coventry. [4443

BRITISH WEST INDIAN AIRWAYS CORPORATION have vacancies for Second and First Officers based in Trinidad. Applicants for Second Officer vacancies should have Commercial or Senior Commercial Pilot's Licence with Instrument Rating, and First Officer applicants should have Airline Transport Pilot's Licence or Senior Commercial Pilot's Licence with Instrument Rating. Experience on Dakota, Viking and Viscount aircraft a desirable qualification. Salary rates and conditions of service are good. Applications in writing to Personnel Officer (Associated Companies), B.O.A.C., H.Q., Building, London Airport, Feltham, Middlesex. [4402

THE Mullard Radio Valve Co., Ltd., has vacancies for development engineers in its expanding semi-conductor division. The work involves investigations into the properties of semi-conductor devices and pursuing their development. This is a new and expanding field in the electronic industry and as far as possible applicants should be graduates with some electronic experience. In certain cases applicants possessing the Higher National Certificate in electrical engineering will be considered. The commencing salary will be according to qualifications and experience. Applications should be addressed to The Personnel Officer, Mullard Radio Valve Co., Ltd., New Road, Mitcham Junction, Surrey, quoting reference SCD/JFG/SW. [4438

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A number of positions exist for Engineers and Technicians in the Australian Division of Sir W. G. Armstrong Whitworth Aircraft Ltd. All these positions carry attractive salaries and successful applicants will be eligible for a superannuation scheme. Passages to Australia for applicants and their families will be provided and assistance will be given in obtaining housing.

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Technicians. Max. age 35 years. Should have H.N.C. or equivalent in Mechanical or Electrical engineering and have experience in the aircraft or G.W. fields.

Applications should be made to the

Staff Employment Officer,
Sir W. G. Armstrong Whitworth Aircraft, Ltd.
Whitley, Nr. Coventry.

SITUATIONS WANTED

COMMERCIAL Pilot, 25, instrument/rating with 950 hours, seeks position; anything considered. Box No. 7448. [4457

BOOKS, ETC., WANTED

ANY Aviation books and photos wanted, especially Janes, 1914-18 narratives, 1939-45 recognition booklets and magazines. Send for free list of highest cash prices paid. Aeroplane Book Supply (Dept. 7), 28 St. Andrew's Gardens, Toronto, 5, Canada. [4225

BOOKS, ETC.

"MECHANICS for the Home Student," by Eric N. Simons, in association with W. D. Burnet, B.Eng., Lecturer in Mechanical Engineering at Sheffield University. The nineteen chapters of this practical book provide an excellent introduction to the subject under such headings as action, force, momentum, power, applied force, friction, centre of gravity, density, fluids, gases, heat, vibration, stress, impact, rotation, etc. 7s. 6d. net from all booksellers. By post 7s. 10d. from Iliffe & Sons, Ltd., Dorset House, Stamford St., London, S.E.1.

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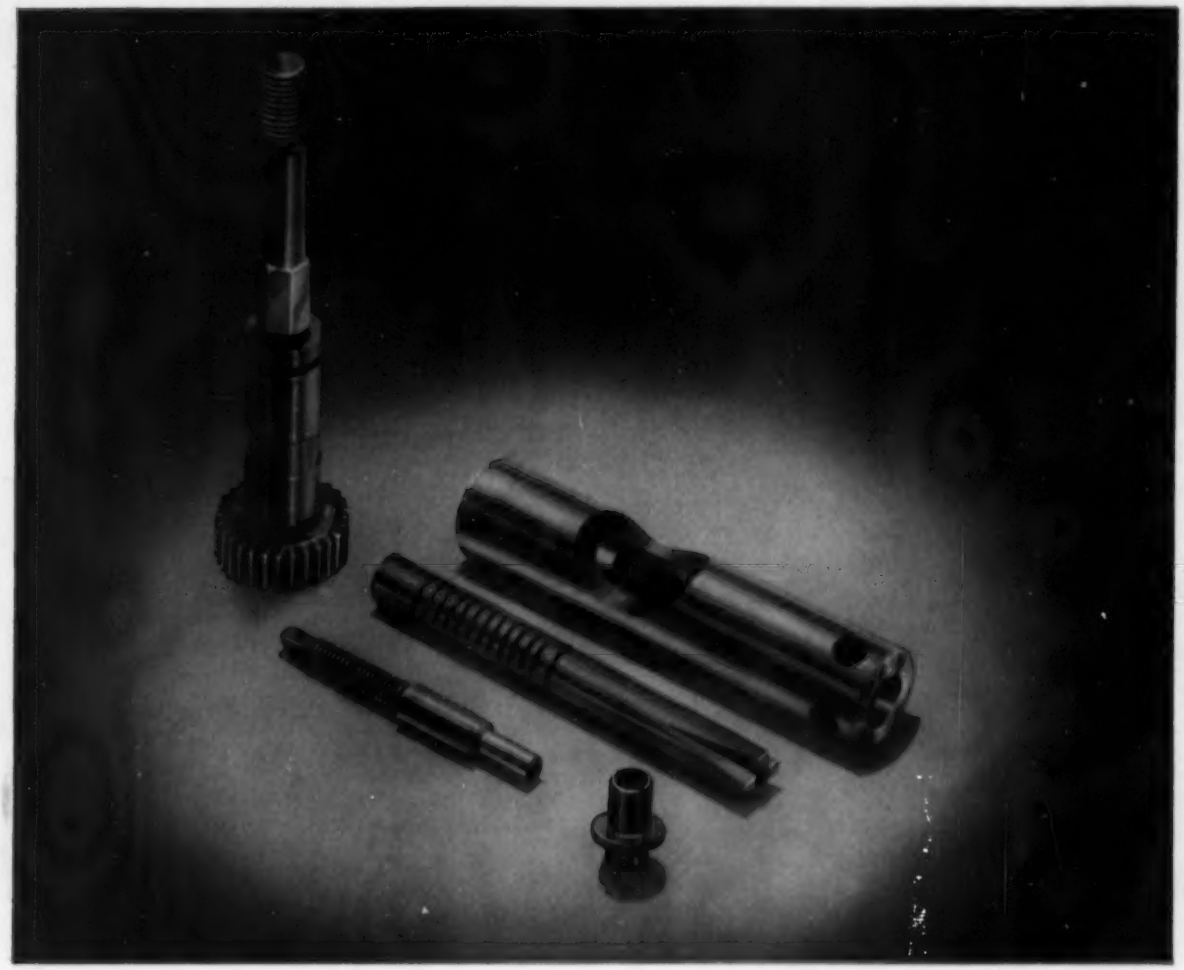
Printed in Great Britain for the Publishers, ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1, by IAN PRINTERS LTD., London, and Watford, Herts. *Flight* can be obtained abroad from the following: AUSTRALIA AND NEW ZEALAND: Gordon & Gotch, Ltd. INDIA: A. H. Wheeler & Co. CANADA: The Wm. Dawson Subscription Service, Ltd.; Gordon & Gotch, Ltd. SOUTH AFRICA: Central News Agency, Ltd.; Wm. Dawson & Sons (S.A.), Ltd. UNITED STATES: The International News Co. Entered as Second Class Matter at the New York, U.S.A., Post Office.



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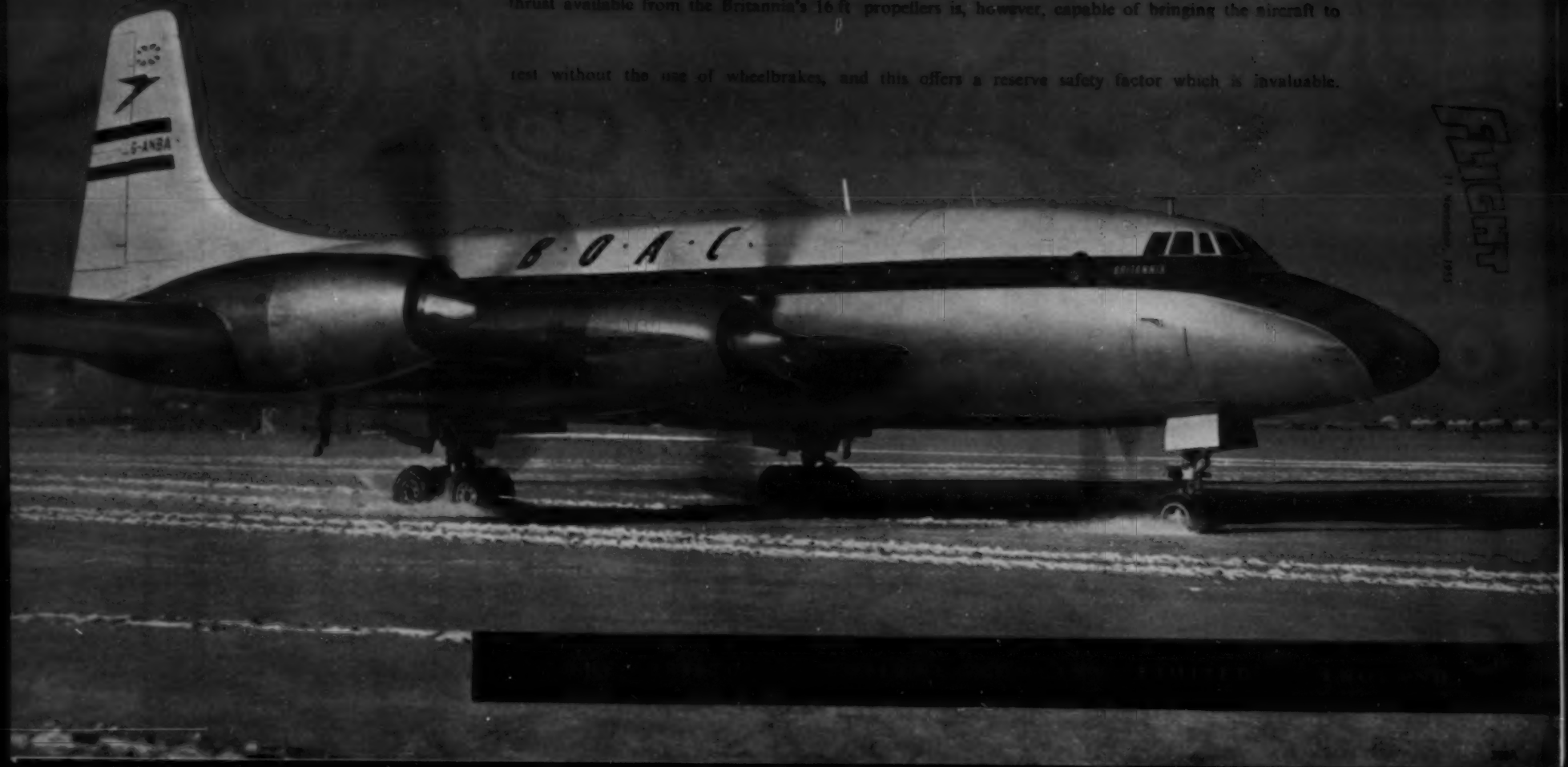
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